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# FIFTY YEARS OF PROGRESS.

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C. E. WEST.



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# AN ADDRESS

ON THE

## FIFTIETH ANNIVERSARY

OF THE

CLASS OF 1832,

PARTS OF WHICH WERE READ AT A CLASS MEETING AT  
UNION COLLEGE, JUNE 27, 1882.

BY

CHARLES E. WEST.

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*Omne tulit punctum qui miscuit utile dulci  
Lectorem delectando pariterque monendo.*

—HORACE.

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1882.

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By CHARLES E. WEST.

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## APOLOGY.

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Of what value is a book without a *preface*? And what is a *preface* but a *postscript*? In a letter, it forms its *conclusion* and is put *last*; in a book, it is the *introduction*, notwithstanding it is the afterthought, used either in the way of explanation or of apology. It is here used in the latter sense.

When I sat down to prepare this class-paper, I little thought that it would reach its present dimensions; or, that its publication would be solicited. The compliment, I fear, comes from an undue partiality, and is an undeserved honor.

Our last meeting at the college was one which will never be forgotten. To look into the faces of classmates we had not seen in fifty years and observe the changes time had wrought; to grasp by the hand the companions of our boyhood; to listen to the tales of those who had returned to their Alma Mater, perhaps, for the last time; to pass in review the incidents of each others' lives; to recount the virtues and achievements of those who had passed away, and drop a silent tear in affectionate remembrance; to forecast our own departure which is so near at hand; to walk about the college grounds and think that fifty classes had come and gone; to realize that the most of the men we knew in our college days had joined the long, silent procession and had forever disappeared from human vision; to realize all this, seemed like an unreal dream—shadows in the shadow-land. But, after all, we felt sure that we had not lost our personality,—that we were the same sentient, thoughtful, active beings, as in days of yore. We could laugh and cry. Our sympathies were as keen and fresh



as ever. Naught had grown old but the *caskets* of the living spirits. Time, thank God, had naught else he could work upon! We had reached a mature manhood, and could look back over the track we had pursued and see the dangers we had escaped and the conquests we had won. We could look across the narrow chasm before us and see the shining gates of pearl. It was a pentecostal season. The Divine protection was invoked that our steps might be guided in the future as they had been in the past.

After finishing what I had to say of classmates and of the President and Professors, I was tempted to take a survey of the wonderful panorama of events of the last half century; but I soon found that I was sailing on a *mare incognitum*, and that if I ever wished to make port again, I must turn the prow of my vessel and sail homeward.

Pardon me for the great length of my manuscript. As it is for private eyes and not for the public, I feel sure that your criticisms will be charitable. I shall be happy if I have interested you by calling attention to some of the mile-stones which have been set up in the grand march of civilization in our day. It has been a great privilege to live and witness the marvellous development in every department of human thought and enterprise. To the preparation of this address, I lay no claim to originality. I have drawn from the accumulation of scientific and statistical materials of the past half century.

I regret that I have not been able to learn about some of our classmates, whose names are not starred in the triennial catalogue. If living, their residence and occupation are unknown to me.

I am sorry that I had not the *materials* for sketches of many classmates who achieved honorable positions in their several professions and spent their lives for the benefit of society. Many of them were bright and shining lights.

It was a great disappointment that some of our brethren whom

we had expected failed to come. Their letters of regret explained the reasons of their absence.

From our first Class-circular, we learn that the honor of organizing a Class Association belongs to the Class of '32. I know not whether our example has been followed by any other Class or not. At any rate, it has been a source of great pleasure to us who have participated in it, and we can recommend it to other Classes. Such meetings are also an advantage to the college.

We would be wanting in courtesy not to acknowledge our obligations to the college authorities, and especially to Professor Lameroux, who secured rooms for us at the hotel and accommodations for our meeting at the college.

Grateful, dear Classmates, for the privilege of attending our recent meeting, and for the pleasure your presence and words afforded me,

I am sincerely yours,

CHARLES E. WEST.

BROOKLYN HEIGHTS SEMINARY,

October, 1882.



# ADDRESS.

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## CLASSMATES OF '32:

By a resolution of the Class, at its last meeting in 1862, a committee consisting of Charles E. West, Hamilton W. Robinson and A. P. Cumings, was appointed to publish a corrected catalogue of the Class, with an address, and the minutes of that meeting; and they were also authorized to call a meeting in 1867.

Unfortunately, there has been no meeting of the Class for the past twenty years; and, as my associates of the committee have passed away, it has fallen to my lot to discharge this official duty *alone*.

Our first meeting was in July, 1842. After an absence of ten years, it was a pleasure to return to our Alma Mater and renew the friendships of early days. It was a joyful occasion. Our fraternal greetings were sincere and hearty. We had seen something of the world. Many of us had entered upon professional life. Large spheres of usefulness were opening to our ambitions. The world seemed bright. Many an hour was spent in telling our experiences. Some had married and their firesides were made musical with the prattle of children. Our venerable President was living and in active service. It was delightful to meet again the "Old Man Eloquent" and receive his benediction. Many of our professors were actively engaged in college work. The Mohawk valley was unchanged—the quiet river still pursued its placid way. "Durup" itself, although a University city, had not undergone such commercial alterations as to obliterate its old land-marks and make it unrecognizable! We readily found our way from the railway station to the college grounds, but missed some of the familiar signs, as Clute's and Duncan's, on Union street. The college buildings had not undergone a particle of change. The same massive walls—the same brick-paved halls—the same old stair-ways with balustrades substantial enough for a

military fortress—the same unique rooms with the doctor's anthracite stoves—parlor, bed-room and store-room all in one. In front, the same beautiful panorama of landscape and sky, spreading far to the west. In the rear, the college gardens, filled with evergreens and sweet-scented bushes, especially "Captain Jack's" garden, which was a new creation and has since become so celebrated. Being a farmer's son, I remember the questions he used to put to me as to the best modes of planting and sowing of seeds, for he commenced his gardening during our college course. How warmly he greeted us on our decennial return! He was nature's nobleman and commanded the love and veneration of all his students.

Yes, the college buildings and the instructors were as in days of yore—but, in all other respects how changed! Among the students we saw no familiar faces! Classes had come and gone! We were strangers and received no tokens of recognition! We had had our day, and had gone out into the great world never again to be summoned to college duties! We felt isolated and alone; and with closed doors we shut ourselves in and communed with each other. It was a precious season. The absent, the living and dead, were enquired about; many had gone to the silent land, *qui fuerunt, sed nunc ad astra*. Our poet, John W. Brown, read an elegiac poem commemorative of the fifteen deceased members. He took as a motto to his thanatousion the inscription upon Hinman's monument, in the college grounds, who was the first to die:—

"Etsi procul a propinquis.

"In morte quiescit.

"Amici plurimi, non sine lacrymis.

"Sepulchrum revisent."

The introductory verse of his hymn is as follows:

"From the world's crowded scene of toil and strife,  
From various paths through which our steps have sped  
With various fortune in the race of life  
We come these classic halls again to tread  
To greet the living and to mourn the dead—  
Ten years of stern or bright vicissitude  
Have passed in action big with hope or dread,  
And now we stand again where oft we stood  
In those remembered days, a youthful brotherhood."



Four decennial anniversaries have passed since that memorable meeting of "*the seventeen*," eleven of whom have since gone to the spirit-land; and of these is our sweet poet Brown, who sang for others—but now for himself as well:

"Many are gone, whose morning hours were blest  
 With promise of a bright and glorious day!  
 Some gentle souls sank quietly to rest  
 As the departing sunlight melts away  
 'Mid the delicious bloom and balm of May.  
 Some lie on distant shores, and virtuous deeds  
 Have made their memory holy, and the ray  
 Of blest example to the gloom succeeds,  
 Cheering the heart that o'er the loved and lost ones bleeds.

"Fair, fair in memory's moonlight are they all,  
 The young, the bright, the noble. It is true  
 The silent grave returneth not our call;  
 Our voice wakes not their slumber; from the voice  
 Of living men, from 'neath that arch of blue,  
 From this fair earth forever are they gone;  
 Yet be it ours to pay the tribute due  
 To noble hearts, not with unmanly moan  
 But in that worthy grief which hallows sorrow's tone."

You will pardon me for recalling some of the departed with whom I was on terms of intimacy during our college course and afterwards. And first, Butler Goodrich, Jr. By consent of his classmates, he was regarded, I think, as the most accomplished scholar in his class. Our acquaintance began in the winter of 1825-6 at the old Pittsfield Academy, and was continued at the Berkshire Gymnasium, a celebrated school in Western Massachusetts.

My acquaintance at that time with young men from different parts of the country and from foreign lands, was of immense value to me, some of whom have become distinguished in society,—as Arthur Cleveland Coxe, Bishop of Western New York; Franklin Clinton, son of De Witt Clinton, who entered the U. S. Navy and died young; Thomas Allen, Member of Congress from St. Louis; Henry Shaw, the eccentric "Josh Billings;" Mariano Valdez, the revolutionist, of Peru, South America.

But, of all the young men in the gymnasium with whom I was most intimately associated, was my townsman, Butler Goodrich. He was modest and gentle in disposition. He had an analytic mind, was fond of mathematics and abstract science, had great fondness for the Latin and Greek languages—was untiring in his application to study. His masterly scholarship soon attracted attention, and the highest rank was unanimously awarded him. We were poor boys, and found it difficult to break away from business to attend school. It was in the retirement of our bed-room, we passed a sleepless night in maturing our plans for obtaining an education at whatever sacrifice it might cost us. I shall never forget that night. It was in the month of April, 1828. When the morning light broke, our ears were saluted by the songs of robin and blue-bird. Our plans were formed, and we arose from our beds as happy as the birds. For nearly ten years we were as *one*—our intimacy was perfect. We could not bear to be separated in vacation, but passed it at each other's houses. We entered Union College in 1830, and graduated two years later—the year of the terrible Asiatic cholera.

In the fall of 1833, Goodrich came to Albany, and passed a year as a teacher in the Albany Female Academy. I had preceded him and established a school for boys. We were together *once more*. We attended Rev. E. N. Kirk's church—had heard him preach in the college chapel. In religion Goodrich was skeptical. But he liked the earnest and devout eloquence of Mr. Kirk. During a religious awakening in his church, we became interested in a series of religious services. They were novel to us; and, at first, we attended them more from curiosity than from a desire of gaining any personal advantage, till at last we began to feel that there might be something in religion worthy of attainment. We had many misgivings. We did not like the methods. They seemed mechanical. Submission was mortifying to manly pride. Night after night we fought against it; till at last, our conviction of the necessity of personal religion led us, after many struggles, to sign the following pledge:

“We solemnly pledge ourselves that we will attend to the subject of religion immediately; and, if permitted to attend

meeting to-morrow evening, we will do everything in our power for the salvation of our souls.

“CHARLES E. WEST,

“B. GOODRICH, JR.

“ALBANY, February 17th, 1834.”

What memories crowd upon my mind as I copy these few lines which had such a practical bearing upon our destiny.

Many years after, Dr. Kirk sent me the following note and a “Pastor’s Sketch:”

“MY DEAR WEST:

“It just occurred to me to put in print our memorable interview, because the statement of it has been beneficial to other persons. I shall make No. 2 handle the difficulties about community with three persons and one essence.

“Your affectionate friend,

“EDW. N. KIRK.

“BOSTON, April 2, 1856.”

The sketch, entitled, “INTELLECTUAL DIFFICULTIES IN RELIGION,” No. 1, “THE BEING OF GOD,” I give in full:

“There are such difficulties; and it is very desirable that they be removed so far as explanation and suggestion can do it. And it is equally important to guard against an advantage the enemy of the truth often takes by making it appear that these difficulties are peculiar to religion; and that, therefore, persons who have not leisure for much study are excusable for not attending to religious doctrines.

“Now, it should be noticed that the higher any subject rises in intrinsic grandeur or permanent importance to man, the more does it lie out of the ordinary range of thought, and the more does it require of the employment of those powers which are not most frequently in exercise.

“Man is made to be conversant with spiritual just as much as with material objects; and yet the daily and hourly exercise of the senses makes man more familiar with the latter than with the former; and thus our susceptibility to impressions and to evidence depends upon our habits. A mere mathematician becomes exceed-

ingly keen in his perceptions of mathematical evidence; but he is exposed to overlook a kind of evidence immeasurably more important for him.

"I once knew two young men who were distinguished as mathematical students. They had formed the habit of requiring a diagram of any object to be presented to the eye before they could form a definite conception of it, and then a mathematical proof was required before they would believe anything not palpable to the senses.

"In this state of mind they were both awakened to a consciousness of guilt and depravity in the sight of God. Under the pressure of this load, they retired from a religious meeting to pray alone. When they met each other the next morning, they found that each had encountered the same obstacle, and had yielded to it. They agreed to go immediately to their pastor and seek his aid. The substance of the conversation I will now give:

"*Pastor*—What is it, my young friends?

"*Student*—I went to my room and kneeled by the chair to give myself to God. The chair was there, the wall, the furniture; and I was there; but there was no one else. And it seemed to be absurd for me to beat the air with vain words, so I arose from my knees discouraged; and, meeting my friend B. this morning, I found that he had passed through the same process; so we have come to seek your aid in the case.

"*Pastor*—Most happy am I to meet you at any time, but particularly under such circumstances. Your difficulty is not an uncommon one. It arises from many causes which are common to us all as compound beings, partly sensuous, partly spiritual. But I deem it not improbable that in your case it has been aggravated by your disproportional development of the mathematical powers. So far, however, as the difficulty is mainly intellectual, you may easily be relieved.

"To you both it seems as if you do not and cannot believe in the existence of mere spirit. But, however common, it is an egregious mistake. You believe in spirit just as much as in matter, and you know as much and even more about it. It is not important now to prove the latter point. But I would suggest the

ground of the assertion. Matter, you know, by a foreign testimony, brought to the spirit, but with spirit you are acquainted by the direct action of the knowing faculty; by that purest, profoundest, clearest, most indisputable of all modes of knowing—consciousness.

“But, to leave that. Imagine, now, that while we are conversing together, I should fall dead before you. Mark now the change in your whole mental action. In an instant, supposing the fact settled, that life has irrevocably passed away, you would begin to conceive and speak of me as gone. But how is that? Who am I? All that you ever saw or heard of me is still there. The diagram is there before your eyes, and yet you begin to think and speak of me as gone—all my qualities you discuss, speaking of your regard for me and my friendship toward you. But of whom are you speaking? You never saw my spirit, its size, form or color. And yet so perfect is your belief of the existence of that invisible being of which even your imagination can make no picture; and not only of its existence, but also of its being all you ever thought of as constituting my personal existence, that you follow it in thought to unknown worlds and refuse to talk to that visible body any longer.

“You believe in spirit, in God. Now return to your rooms and meet God there as you meet me here. Kneel and speak to Him as you now sit and speak to me. He hears you, He sees you; and, if a doubt of his existence or presence comes over you, look at your hand and ask who contrived it; lay it on your heart and ask who keeps it beating.

“They retired. The next interview with their pastor was a joyful occasion. One of them in a few years went to heaven from the midst of his successful labors as a student of theology. The other still lives to honor the cause of his Saviour and train the youthful mind to the knowledge of divine and human things.

“E. N. K.”

In July, 1834, Goodrich resigned his position in the Academy and entered the Theological Seminary at Princeton. On the 18th of November he wrote me: “I have been already several days within the walls of a theological seminary. It is not in the power of pen and ink to describe my feelings as I left Albany. It was



beyond my cool philosophy to check the tears that would, unbidden, drop from my eyes. Was it leaving Albany and my friends there that caused this flow of melancholy? No; I think I could, without one regret, wave all the pleasures and advantages that I enjoyed there even for an unknown and precarious enterprise. I love Albany, not for its excellences, but for its welcome associations to my mind. If I am ever so happy as to enter the regions of the blessed, I shall regard Albany as the sacred spot where I first met my Saviour, and He took me by the hand and pointed me to heaven. At the time I left you, a thousand mixed emotions in rapid succession moved my mind; but what touched me most of all was the greatness of my enterprise, and the fact that I must leave you, who have stood by me in almost every undertaking in life, behind."

During his connection with the seminary, he often wrote me of his work and of the interest he felt in his preparation for the ministry—the loftiest ideal of Christian service that could be conceived. He was grieved that I did not join him in his studies. His cousin, Rev. David White, afterward a missionary to Africa, was with him during his last illness and death, and wrote me that he died in the triumphs of faith. "It was indeed good to a pious heart," he said, "to be present with him in his last and dying hours. His views of eternal things were so clear, so elevated, so heavenly—his confidence in the Redeemer so firm and unwavering—his estimation of his own works so low—his exhortations in the service of his blessed Master so pathetic and forcible—his whole appearance so unlike to mortality and corruption—that we seemed to be looking upon and listening to an inhabitant of that world 'where the wicked cease from troubling and the weary are at rest.'

"On the Monday previous to his death, he enjoyed several lucid hours. He had been informed by Dr. Alexander that his physicians considered him beyond the reach of medicine, and, to all human appearance, very near his end. He received the intelligence with calmness and resignation, and said, 'I wish the Lord's will to be done.' Shortly after, when all had left him but myself and another brother, he discoursed a long time—of death and dying—

of his prospects—of his hopes. He made disposition of his effects, arranged all his business with his usual exactness and order, sent messages to all his particular friends, and made presents to several of them, among whom you were one. He requested me to give you the following message: ‘Tell West the world has many allurements. I believe that he has struggled hard to live above their influence; but still there is danger of living away from the path of Christian duty, or hindered in his progress. Tell him to live near to Christ.’ As a token of his dying remembrance and affectionate regard, he requested me to present you with his valuable flute.

“It may not be improper here to say that Butler often spoke of Mr. Kirk, and at one time remarked, ‘I have not time nor strength to speak of the gratitude I feel for the interest which he has taken in me. I remember him with much affection.’

“His funeral was attended yesterday (February 14) in the chapel of the seminary. Though none of his father’s family were here to follow his remains to their long home, they were attended by a numerous concourse of sympathizing friends. He was borne to the grave by his college acquaintances. He will rest in peace. His memory is blessed.

“DAVID WHITE.

“PRINCETON THEOLOGICAL SEMINARY,

“February 15, 1836.”

He died at the Seminary, February 12, 1836, in the 27th year of his age. The *first* bereavement of my life!

A committee of his class, of which Rev. E. D. G. Prime, D. D., was chairman, was appointed to prepare a memoir of him, and I was requested to furnish the materials, and did so. His death was deeply lamented by the professors and students. In 1868, I obtained permission from the cemetery corporation to remove his remains to my lot in the Pittsfield Cemetery. His grave is on the bank of his loved Housatonic River, on the opposite side of which, and at a short distance, is the house where we spent the night to which reference has been made. To conceal my thought from the ignoble crowd who wander in cemeteries like ghouls and desecrate the soil which covers the precious dust of the dead, I wrote the following Latin inscription for the marble which marks his grave:

*Hic sepultæ jacet reliquie mei amici qui e terra ad astra translatus fuit. Plurimæ sunt causæ cur illum semper amabo. Viator, sta et si flere vis, tecum revolve adolescentis mortem qui si vixisset ornamentum ecclesiæ et societatis insigne bene esse promisit.*

Another, and perhaps the most brilliant man of his class, was Alexander W. Bradford, who died November 5, 1867.

I was appointed by the American Ethnological Society of New York to prepare a minute of his life, services and death, which were entered on its records, as follows:

That in testifying to our respect for the ability, attainments, character and usefulness of the deceased, we do not feel inclined to indulge in empty panegyric, or enter into lengthy discussion of the combination of excellences which formed his manhood and made him conspicuous in his professional and private relations, as councillor, scholar, Christian and friend. Mr. Bradford was born in Albany, N. Y., February 21, 1815. He was the third son of Rev. John M. Bradford, D. D., pastor of the North Dutch Church in that city, and received his preparatory education in the Albany Academy, then under the care of that accomplished scholar, T. Romeyn Beck, M. D.—an institution which then took rank with the foremost colleges of the State. Here Mr. Bradford gave an earnest of the success which was to follow him in the arena of professional life. At the age of 15, he entered Union College and was the youngest member of his class. In college, he was distinguished for acuteness of intellect and diligent application to study. He was particularly fond of mathematics, making marked attainments in the higher analysis and in its application to mechanics and physical astronomy. In this connection, I remember him with pleasure, as an opportunity was afforded of witnessing his inventive power on this higher plane of intellectual discipline. Selecting the legal profession, he was admitted to the bar, in 1838. In 1843, he was elected Corporation Attorney, and in 1848 was chosen Surrogate of the City and County of New York, holding the office till 1858.

It is not my province to pronounce judgment upon the

industry or the value of his services in this department of labor. This must be done by his legal peers and associates. Here, it is sufficient simply to refer to his voluminous reports which were prepared with great labor and research, and unite an equitable interpretation of the well-established rules of jurisprudence. His decisions will command respect in the arbitrament of all difficult cases of probate, and upon them will rest his reputation as a scholar and jurist.

After the close of his office as Surrogate, he served one term in the Legislature and then resumed the practice of law in New York, which he continued until his death.

For his learning and integrity, Mr. Bradford received numerous testimonials of respect. His Alma Mater, in 1852, conferred upon him the degree of LL.D., and elected him a trustee of the college. He also served as trustee of Columbia College. He was a member of various literary and historical societies of the country; also of the Royal Northern Antiquarian Society of Denmark. Ethnology was a favorite study, and had he devoted himself to research in this department, he would have achieved honorable distinction. As it was, he became a pioneer in American Archaeology. His work, entitled "American Antiquities," was prepared when a young man, and at a time when scarcely anything had been written upon the subject, and is characterized by diligent research and careful deductions from the mass of facts which lay in chaotic confusion—a digest, which will continue to be a valuable reference to the student of history.

But, in estimating the character of our friend, we should be wanting in fidelity to him did we neglect to speak of what is better than talent, or genius, or learning, or professional reputation—did we forget those noble qualities of justice and humanity—that regard for truth and moral excellence—that love of God and man which characterized his life, and made him an example worthy of imitation. He has gone, leaving a record which will grow brighter and brighter in our recollections of him; and, as we journey to the same bourne, let us be grateful that it has been our privilege to know him and receive inspiration from his words and example.

Rev. John H. Raymond, LL.D., was born in New York in 1814. In 1828, he entered Columbia College; and, after remaining there for three years, he joined our Class at Union. In 1838, he completed his theological studies at Madison University; was appointed professor in Rochester University in 1851; was called to the Presidency of the Brooklyn Polytechnic Institute in 1853; and, in 1864, he was chosen President of Vassar College for young women.

For fourteen years he presided over that institution, and was permitted to witness its great success, and to confer the diploma of the college on more than 360 graduates. On August 14, 1878, he died in the full maturity of his powers. His great work in the establishment of Vassar was done. To its success he had brought an organizing mind, a finished education and a large experience in the management of institutions. Great wealth was put at his disposal with which to organize and equip the several departments of instruction. Costly and well arranged college buildings had been erected. The question in regard to woman's ability to grapple with the higher mathematical and abstract sciences had already been determined by Rutgers Female College of New York, which is the mother of all the colleges for the higher education of women in the United States.

Dr. Raymond was an accomplished Christian scholar. He was distinguished for great symmetry and beauty of character, for lofty ideals of human perfectibility, and for an unreserved consecration of himself to the moral regeneration of society. He has impressed his pure and noble character upon his generation, and left a record more enduring than that of marble in the affection of those for whom he toiled.

Do you remember our classmate Lathrop? He was poor and had to struggle hard for his education. He prepared his own meals, and occasionally made buckwheat cakes. He studied mathematics under Captain Jackson. At a recitation, one morning, on Osculating Curves: "Well, Lathrop," said Jackson, with his legs dangling over the arm of his chair, "how are the buckwheats?" "First-rate," was the reply. "And how is the



lesson? Do you understand osculating curves?" "The *theoretical* part, professor, I have not mastered," said Lathrop; "but, if you will give me a girl with sweet, pretty lips, I will show you my proficiency in the *application* of the theory!"

Lathrop studied law, came to New York to pass his examination, was admitted to the bar, and, on his return home, so overpowering was his joy in winning the goal of his ambition, he lost all control over himself, and died at Albany in the wildest delirium.

Lincoln B. Knowlton was an odd character. He was regarded by some as a great genius. He had the reputation of getting his lessons without study—would frequent students' rooms during study-hours, and boast of his intuitive superiority to the plodding, painstaking drudgery to which his classmates were subjected. It was said, however, that he passed the midnight hours in hard and patient study. In personal appearance he was careless, dressed shabbily, and took pride in it.

He liked to amuse himself and others in various ways, and did queer things. He was annoyed, as we all were, with the *cimex lectularius*, and how to keep the pest out of our beds was a serious problem. Knowlton hit upon the following scheme: He laid the mattress on the floor, and put a wall of coal-ashes around it; then, between the bed and the ashes, a circle of molasses was drawn. He reasoned that, if the vermin scaled the ash-entrenchment, he could not get through the molasses. But, in this he failed, and the failure has ever since been a college conundrum. The only solution ever proposed was that the varmint ran up the walls, over the ceiling, and came down like a vulture to do his bloody work.

Knowlton studied law and settled in the West. Farnham told me that, on his way to the Pacific Coast, he saw Knowlton presiding as a police justice in a log-house in Illinois, and that he looked just as he did at recitation, or sitting on a college fence. He died in 1854.

Judge Hamilton W. Robinson died after a year's illness, April 7, 1879. I attended his funeral. A large number of his legal

acquaintances were present. Rev. Dr. John Hall officiated, and delivered an appropriate address to the members of the bar on their duties to themselves and society, urging the importance of personal religious consecration of themselves to the Great Judge of all. He spoke in kindly terms of the deceased, and of his confidence in his Christian character.

He was early associated in business with John Van Buren. I entered their office as a law student, and continued till I was admitted to the bar, in 1844. Robinson was profoundly read in the law, and used to prepare the cases, while Van Buren did the talking in court.

I also attended the funeral of John McClelland, M. D., one of the distinguished physicians of New York; and also that of the Hon. D. R. Floyd Jones, the successful politician, and at one time Lieutenant-Governor of this State. McClelland died April 12, 1876, and Jones, January 9, 1871.

The practical business man of the Class while a student, was A. P. Cumings, who supported himself in college by getting subscriptions to the *New York Observer* and other publications, in his vacation excursions in the country on horseback. After graduating, and studying theology at Princeton, he was taken into the *Observer* firm as a partner, where he remained for life, contributing his financial skill in establishing one of the most influential and useful religious papers in the country. He was the oldest man in his Class, and was on the most intimate terms with Dr. Nott, who had great confidence in his wisdom and integrity. He was born in Dover, Dutchess County, N. Y., July 4, 1803; graduated from Princeton College in 1835; was licensed by the Presbytery of New Brunswick, October 21, 1835, and was Editor of the *New York Observer* from 1836 to 1871. While traveling in Europe in 1870-71, he was attacked by paralysis at Nice, France, and died within a few days, May 13, 1871, and was buried in that city.

Mr. Cumings was very active in Christian and benevolent work in New York, was a prominent director of the American Bible Society, and served for many years on some of its im-

portant committees. He was a friend of education, and of every good cause for the improvement and happiness of man.

A loving friend writes: "The circumstances of his death and burial were in keeping with his humble, retiring life. In an upper chamber of a hotel, at the hour of midnight, attended only by his wife and a young friend, with two Italian men, the end came to him. Nor was his progress to the grave, far from kindred and home, marked by any funeral pageant. But in the pleasant British Cemetery of "Caucada," on a hill overlooking the Mediterranean—amid a flora of unrivalled beauty and surrounded by olive groves, there the American traveler, visiting that lovely region for health or pleasure, may find a stone inscribed, "Abijah P. Cumings, of New York, U. S. A., aged 68."

"The tears of children (not his own) whom he has educated—of the widows and orphans he has befriended—of the strangers he has "taken in"—of the "sick and in prison" he has comforted—of the servants of his own household, will not fall upon that grave. But the remembrance of such a man will live in a multitude of hearts."

One of the ablest and most useful men of the Class was Rev. James M. McDonald, D. D. He was born in Limerick, Maine, May 22, 1812. He pursued his theological studies at Yale College. In 1835 he was settled pastor of the Congregational Church in Worthington, Conn., and in 1837, of the Church in New London—was called to the Presbyterian Church in Jamaica, L. I., in 1841; and in 1850, to the Fifteenth Street Presbyterian Church of New York; and two years later, to the Presbyterian Church in Princeton, N. J., where, for more than twenty years, he continued to preach the gospel with great success.

He was a voluminous writer. The following are the titles of some of his publications: "Credulity, as illustrated by successful impostures in Science, Superstition and Fanaticism;" "Key to the Book of Revelation;" "History of the Presbyterian Church of Jamaica;" "My Father's House, or the Heaven of the Bible;" "The Book of Ecclesiastes Explained;" and "The Life of St.

John." He was a frequent contributor to the *Princeton Review* and the *Bibliotheca Sacra*.

He was a man of fine personal appearance, of genial and attractive manners, of large and varied learning in his profession. He was prudent in speech, wise in counsel, positive in his convictions, and earnest in his advocacy of the truths of religion. He died, sincerely lamented, April 19, 1876.

J. T. Farnham, although not a graduate, was a member of our Class. The college afterward conferred a degree upon him. In some respects, he was a remarkable character. Tall, and of commanding personal appearance, he was sure to attract attention. Restless in spirit and fond of adventure, he could not be confined to any ordinary pursuit, and at a very early day after leaving college, he set out on the perilous undertaking of making his way across the continent, an account of which he published under the title of "Travels in the Great Western Prairies." He afterwards published a sequel to the first, entitled "Life, Adventures and Travels in California." In his preface to the latter work, he says, "I wrote my 'Travels in the Great Western Prairies,' with little belief that they would excite any attention beyond the circle in which personal friendship would in some sense link the reader with the events narrated. I did not comprehend the extensive interest felt in journeying over the wild and barren realms of uncultivated nature. I did not suppose that the dim outline which words could give of the snow-clad peak, the desert-vale, and the trials and dangers which crowd about the pilgrim on the western deserts and mountains, could be made sufficiently distinct to convey even a satisfactory shadow of their sublime, fearful nature. But the very unexpected favor with which that work has been received, has led me to conclude that such matters, related as far as they may be at all, with fidelity, are valued as useful knowledge. Indeed, we may learn much from the pulseless solitudes—from the desert untrodden by the foot of living thing—from the frozen world of mountains, whose chasms and cliffs never echoed to aught but the thunder tempests girding their frozen peaks—from old nature, piled, rocky, bladeless, toneless—if

we will allow its lessons of awe to reach the mind and impress it with the fresh and holy images which they were made to inspire." In his first work, "I left," he says, "my readers off the mouth of Columbia River, in sight of the green coast of Oregon. Lower Oregon! A verdant belt of wild loveliness! A great pack of flowering shrubs, of forest pines, and clear streams! The old, unchanged home of the Indian; where he has hunted the moose and deer, drawn the trout from the lake, and danced, sung, loved, and warred away a thousand generations."

I have been unable to obtain any information in regard to the time or circumstances of his death. His widow was, for some time, Matron of the prison at Sing Sing, and did much for the moral improvement of the prisoners. In 1844, I sent her a set of wall maps for the benefit of the convicts. In acknowledging their receipt, she wrote: "They are of the greatest service in the course of instruction we are now pursuing. Half an hour each morning is spent in a lesson on the early history and discovery of this Continent, and these maps add incalculably to the interest which dull minds feel in the mere narration. Every act of liberality like this lightens our labors, and inspires hope and self-respect in the unfortunate beings whom we are, in our humble way, seeking to make better and happier. Our success, thus far, has been commensurate with our highest hopes."

Mrs. Farnham was the author of several volumes.

Eliphalet Cramer completed his academic studies preparatory for college at the Berkshire Gymnasium in 1829. It was at the gymnasium that I first met him. At that time he was but fifteen years of age. Everybody liked "Lif" Cramer, as he was familiarly called. He had a kind heart and a kind word for everybody. My intercourse with him was intimate. For four years, we were constant companions. We were members of the same College societies—the Philomathian, the Kappa Alpha, and the Phi Beta Kappa. The title of his paper, at the graduating exercises, was "National Degeneracy."

I don't remember of having met him after we parted on Commencement day.



From an obituary sketch which has been furnished by his daughter, I have gained the following particulars: He was the eldest son of Hon. John Cramer, a distinguished citizen of Waterford, N. Y.; was born, June 18, 1813; studied law and was admitted to the bar; removed in 1837 to Milwaukee, Wis.; engaged in mercantile pursuits, and was largely interested in real estate; was one of the organizers and first President of the State Bank of Wisconsin; was one of the earliest members of the Plymouth Church, a deacon and one of its most liberal supporters; was a large contributor to the funds for establishing Beloit College and the Chicago Theological Seminary; was proud of his adopted city and invested largely in its real estate; was in active business until two years before his death; amassed a large fortune, which was used for the benefit of society. He died, September 19, 1872, deeply lamented by all classes of society who had shared in his benefactions. He had contributed to the rapid and marvellous growth of his adopted city and had seen it a mere hamlet of a few pioneers and backwoodsmen, rise to the dignity and wealth of a large commercial city. During his long residence there of more than thirty years, he was honored with many evidences of respect from his fellow citizens by the offices of trust and responsibility committed to his keeping.

His memory is lovingly enshrined in many hearts.

The telegraph brought the sad news from Washington, April 8, 1882, of the death of Thomas Allen.

Allen was my life-long friend. As boys, we began our Academic career together. Our fathers were farmers and lived in distant parts of the town; so that in early childhood, we rarely met. His father was a leading citizen, and took a prominent part in public business. In this way, I early came to hear of Jonathan Allen, the father of our classmate.

The Allen family was distinguished among the yeomanry of the town and State. The grandfather, the Rev. Thomas Allen, was the first settled minister of Pittsfield, and took an active part in the American Revolution. He fired the first gun, on the Colonial side, at the battle of Bennington; was instrumental in arousing



the patriotism of the people in Western Massachusetts, and was among the foremost by speech and pen in achieving our national independence. After the war, he took an active part in politics. His pulpit was the arena for the examination of the great underlying principles of Republican institutions. He espoused and warmly advocated the political doctrines of Thomas Jefferson. He hated the dogmas of the Federalists, as taught by John Adams and Alexander Hamilton. The party lines were sharp and decisive. Jefferson's opposition grew out of his hostility to Mr. Hamilton. They were rivals. Hamilton had devised the Funding System, which was one of the great measures which distinguished Washington's administration. The system of revenue adopted under General Washington was also the work of this distinguished financier; and so perfect was it found to be in practice amid all the changes and violence of party, and under the administration of those who were originally opposed to its adoption, that they severally found it necessary when placed at the head of the Government, to continue the system which he had devised. Even Mr. Jefferson himself, during the eight years that he held the office of chief magistrate, never ventured to adopt a new system of finance; but adhered in all its essential particulars to that devised by Hamilton.

"*The fighting parson*" hated *Federalism* in politics as much as he did *Armenianism* in religion. His church was split into factions, which darkened the close of a long and useful life. He was generous, warm-hearted and sympathetic; he was the friend of the poor and sorrowing. His funeral discourses, many of which were published, were remarkably tender and affectionate—a literature which has almost entirely passed away. On marriage and festive occasions, he was the life of the company. All could approach and share in his genial nature. But, mention the subject of politics, during a Presidential campaign, and his whole nature was in a blaze. In the political struggles of our own times, we have hardly anything to match it. But, in it all, he was thoroughly honest and disinterested.

I present the foregoing historical data as a background to the portrait I would draw of our democratic classmate. He was a

worthy scion of the old Berkshire parson. *Honest*, but *never offensive*, in the maintenance and declaration of his opinions, he rarely excited antagonisms such as we have noticed in respect to his grandfather. He was born in Pittsfield, August 29, 1813. Passing his childhood and youth on his father's farm, and attending the village academy and the Berkshire Gymnasium under that accomplished teacher, Prof. Chester Dewey, he fitted himself for and entered college in 1830. Neither in the gymnasium nor the college did he attain the highest rank for scholarship. His standing was respectable. He was popular with the faculty and the students. His preferences in study were natural history rather than mathematics or the ancient classics. He excelled in English composition. In manners he was dignified and genial, was kind and true in his friendships. He was an ardent lover of nature—was fond of rural sports. His rod and his gun were his constant companions during vacation. He loved to throw the fly to the speckled trout, and chase the fox over hill and valley. He was a close observer of the peculiarities and habits of wild animals. He studied birds, and used to dissect them for instruction and amusement. Had he been under the tuition of Audubon, he would have ranked high as an ornithologist. He had an eye for form and color, and would have shone as an artist. His temperament was delicate and in sympathy with the æsthetic and beautiful rather than the abstract in speculative philosophy. We boys knew each other—our tastes, our trials, our aspirations. We dreamed and speculated about the future. We built air castles and filled them with precious treasures. What young man don't do this?

Before leaving college, he chose the law for his profession. With twenty-five dollars, the only patrimony his father could give him, he set out for New York, in the Fall of 1832, and entered upon the study of law. From that city he wrote me in the Spring of 1833. A few extracts from his letter I will give, to show the character of the young man who had not reached his twentieth year.

In speaking of the choice of a profession, he says: "I have long been of opinion it is best for a man to follow nature. He

should examine himself, and ask where he can shine with the most honor and profit. Can he command an army or a fleet? Has he the art of a Courtier? Has he those qualities of mind, manner and speech which will make him shine at the bar? Or, has nature fitted him for the clerical or medical profession? Once settled, he should choose without delay. Let everything be sacrificed, except, of course, those finer qualities of the heart without which man is a brute, and no profession should, or does, exclude their cultivation.

"Now, then, if you are after *money*, there is none more profitable on that point than the law. If honor, lay hold of the law. If political eminence, lay hold of the law. As a science, none goes beyond it in dignity or extent. As a study, you will find channels of amusement and instruction that extend into every department of life.

"Now, then, for a location. If you mean to depend upon the pure practice of the profession you choose, of all places in this country this is the one, the city of New York. I found when I came here, with all my college pedantry and imaginary knowledge I just knew nothing at all. Our college life put trammels upon us which it is difficult to throw off. Those very trammels are on you now. You are dreaming, refining, fearful, apprehensive, undecided; but such a man will find no sympathy with the world. You must come out and take an active and decided part. Men of the world are all in action, contending with each other, face to face, for honor and independence. You must come out; and, if you would do as other, and perhaps as the most successful are doing, you must *humbug* the people. The science of humbug is getting to be the most profitable of all sciences. We have been humbugged long enough. Let us take our turn and *humbug*, too.

"I have had a sneaking notion of going West; and, if I should get a good offer, I may go yet. The chances for political eminence are greater there than anywhere else.

"But the practice of the law there must be rather slim. Lands are so cheap that there is every chance for profitable speculation, inasmuch as they are increasing very fast in value. If you should go there, you might ultimately find yourself an extensive land-

owner, and, having grown up with the country, be revered as one of its patriarchs. You might be a Governor, a Judge, or a Congressman!"

Sagacious youth! All this he realized in himself! In the *boy* we see the promise which has been signally fulfilled in the *man*!

Mr. Allen went West and amassed a colossal fortune. Such success would have upset the mental equilibrium of many a man. But it did not serve to disturb his. By wise and judicious management he secured the object of his ambition, and it required all his thought and skill to keep and maintain it. His burdens, great as they must have been, seemed to rest lightly upon his shoulders. In conversation with him, no one would have thought that he had any cares. He was always calm and self-possessed. He put on no airs. In manners, he was courteous and affable, kind and thoughtful of others. His charities were large, but without ostentation. Among these was the founding of a professorship of Mining and Metallurgy in Washington University of St. Louis, and the building of a costly public library for his native town. He purchased his grandfather's estate in Pittsfield, and erected a costly residence for his family. Here he passed his summers in cultivating an extensive farm and rearing a choice breed of Jersey cattle. It was returning to the rural scenes and occupations of his boyhood. It was refreshing to drive with him over his well-cultivated acres, and witness the interest he took in all the details of his well-managed farm. Every cow's milk was weighed, night and morning, and a record of it made. The arrangements for butter-making were excellent. He took great pride in showing his friends what a busy man could provide in the way of relaxation and amusement. Allen lived like a prince, but without ostentation. He had his private palace-car, fitted up with every convenience for housekeeping, which he was privileged to order hitched to any train on any of the great railroad lines, and traverse the Continent at his pleasure—a contrast between this and the old stage-coach we used to travel in, in our college days, when, in the muddy season, he and I had to carry rails to pry it out of the mire!

In contemplating such a career, we find much to admire. If measured by human standards, it is one of signal success. It meets the ideal of this age of materialism. With the multitudes, success in the accumulation of wealth is the only passport to greatness. The Goulds and the Vanderbilts are the heroes of this generation. Great intellectual abilities, great literary or scientific acquisitions, unattended by wealth, are insignificant trophies in the battle of life!

A man is measured by his outward possessions rather than by his culture and moral wealth. But it is true of Allen that he always cultivated a love of the beautiful in nature and art. The accumulation of wealth did not deaden his æsthetic sensibilities or moral instincts. He was simple and temperate in his habits. The coarseness and vulgarity which are often associated with men of hastily accumulated fortunes were never seen in Allen. He was too great a man for that. He had lofty ideals of human greatness. He was familiar with the great names of antiquity. He worshipped the patriots, orators and statesmen of his own country. These had greater charms for him than the tinsel of wealth. He was a man of culture, and had an extensive knowledge of men and institutions.

I need not do more than recite the steps in his successful career. That he was admitted to the bar in 1835; that, soon after, he took an interest in the politics of the day; that, in 1837, he established the *Madisonian*, a political newspaper, in Washington; that he was, soon after, elected printer to the House, and afterward printer to the Senate; that, in 1842, he went from Washington to St. Louis to reside; that he there took an active part in connection with public improvements; that, in 1848, he prepared an address in favor of the construction of the St. Louis and Cincinnati Railway; that he built the first railway west of the Mississippi; that he was instrumental in securing a railroad to the Pacific; that he was for many years a railway president; that he projected and built over 1,000 miles of railroad; that, in 1867, he bought the Iron Mountain Railroad and Cairo & Fulton Railroad, and completed them in two years; that he was a member of the Missouri Senate from 1850 to 1854; that, in 1880, he was elected



to the 47th Congress as a Democrat, and that, soon after, he sold his railway interests and retired from active business.

These are some of the rounds in the ladder of his successful career. He had gained all that this world could afford of wealth, honor and position; he had reared a large and interesting family; he had secured the confidence and respect of a large circle of acquaintances; he had nearly reached the limit of human life; he hoped to spend its evening in the enjoyment of his accumulated treasures; to receive the congratulations of friends for many years to come; to carry into execution cherished plans for the advancement of collegiate education; to witness the deepening shadows of a slowly descending sun, and to sink at last, without pain and without regret, into the bosom of his loving mother—earth!

But, while standing in the council chamber of the Nation, with the possibilities of making an honorable reputation in parliamentary practice, the death-struggle sharp and fierce, came suddenly upon him, and summoned him into another Presence and other occupations!

As I stood, the other day, by his newly-made grave, on which the floral offerings of affection were withering in the morning sun, emblems of all earthly objects, I felt that, after all, there remained something over which Death had no control—and that was the *imperishable character* of such a spirit as his! That *abides*! The flowers may fade; the winds may sing their requiem and die away; the carol of birds may be heard at noon and eventide; but the night cometh when no song of thrush or robin is heard! The green-leafy robe of June puts on its many-tinted autumnal colors, and all is changed. So with this mortal life of ours. It passes away as a shadow, but the spirit abides!

In conclusion, I wish to put on record this interesting testimony to his trust in Divine Providence. In his last illness, he said: "I know not how it is with other men, but I have been a man of prayer all my life. I have always, before important decisions, sought guidance from God." In the excruciating agony he suffered, toward the last, he had the most convincing evidence of God's presence and *revelations of God to his soul*, as he joyfully expressed it. His joy was full!



The usual Congressional honors were paid to his memory by Mr. Dawes of the Senate and Mr. Cockrell of the House. Brief funeral services were held in Washington, at which there was a large attendance of Senators and Representatives. A Congressional Committee accompanied his remains to Pittsfield. Funeral services were held in the Congregational Church. The Rev. J. L. Jenkins officiated, preaching from the text, "Samuel died, and all the Israelites gathered together and lamented him, and they buried him in his house at Ramah."

To relieve my paper of its sobriety, perhaps I should say, of its dullness, permit me to tell a college story, the points of which were given me by an eye-witness, Wells S. Hammond, of the Class of 1833; also by Prof. Averill.

Do you remember the Callithumpian Society? It was a curious association. It operated at night. It visited the rooms of novices and weak-minded students, and spent the night in discussing all sorts of questions. One of its rules was that every member should speak two hours without stopping. In that way the hours of the night were spent and their host victimized.

On one occasion, the consent of Rockwood, who was in the class below us, was obtained to hold their meeting at his room. Rockwood, understanding the character of his guests and the object of their meetings, supplied a very liberal quantity of beer for their entertainment, which he was wicked enough to drug with ipecac. On reaching the short hours of the morning, he informed his guests that it was time for refreshments; and, going to his closet, took a bottle of beer and asked them to help themselves. They all cried out, "It isn't good, is it?" Well, on drawing the cork to his bottle, which he had not drugged, he said, "You can do as you please; I'm going to have some." Then there was a general scramble for the bottles, and the beer was drunk in complimentary toasts in honor of their liberal host.

The debate was resumed. Soon a member quietly left the room, and then another, and another, till Rockwood and his friend Hammond, who had shared the good beer, were left alone. It was a quiet, beautiful night. The stars looked down from their

azure heights. The good people of the college and vicinity were soundly sleeping. There was naught to disturb the quiet of this peaceful night till these midnight debators went forth in all directions and poured out, in flowing streams, the most impassioned eloquence, not from their tongues, but from organs more deeply seated and more acutely sensitive to the ravishing power of stimulants.

After enjoying the fun of this midnight concert, the wicked Rockwood and his friend returned to their rooms and slept out the balance of the night. There were no Callithumpians at the next morning prayers. They were even absent from class-room duties. Where are they? it was asked. The secret leaked out. Everybody soon knew it. The professors were delighted. The students said it was a good joke. In fact, everybody was pleased except the Callithumpians, who had taken more *stock* than they could carry, and were obliged to visit their parental abodes for the invigorating influences of diet and rest.

When we entered Union College, in 1830, Dr. Nott was in the zenith of his popularity, and was regarded by many as the greatest of college presidents. The largest classes were graduated from this institution. Many came from other colleges to pass their senior year and receive the instruction of Dr. Nott in Kame's Elements of Criticism. The government of the college was administered by him. No case of discipline was entrusted to the professors. That he might exercise constant supervision over the young, he took up his residence at the college. His government was parental. By kindness, he was able to guide the most wayward and refractory. Such was the power of his appeals, the most hardened and erring would relent and listen to the voice of wisdom. Many a promising young man was thus saved to his family and society. There is *no written record*, but *here* is to be found the great moral value of the life and services of Dr. Nott,—he saved young man. Who of his pupils does not remember his eloquent appeals in behalf of temperance and morality and of immediate consecration to Christ? In seasons of great religious excitement, which frequently visited the college, the scoffing and

profane were silenced, and induced, in many cases, to enter upon the Christian life.

Dr. Nott was the father of the Common School system of education in this State. He saw that colleges could not flourish without the general education of the people—that common schools would feed the academies, and the academies the colleges—that they were essential parts in a system of universal education, in which every man, woman and child had an interest. While he was seeking from the Legislature an endowment for his college, he introduced, at the same time, a bill for the appropriation of the sales of the public lands for the support of common schools. Both bills met with bitter opposition; but, by judicious management on the part of Dr. Nott, they both passed and received the signature of the Governor, Morgan Lewis. The Doctor was generous enough to have all the colleges of the State share in the college appropriation. The sum asked for Union College was only \$45,000, and this was to be raised by the license of lotteries. The grant was increased to \$80,000. After completing the stone college building with moneys thus appropriated, it was found that the college site in the heart of the city was undesirable; and Dr. Nott, on his own responsibility, purchased some three hundred acres of land on the outskirts of the town and erected the college edifices now in use. This was in 1812. Two years later, the Legislature passed an act for the further endowment of the college, which put it upon a firm financial basis. What is very remarkable in this negotiation of all the collegiate interests of the State, which were left, by consent of Columbia College, in the hands of Dr. Nott is, that that institution came into possession of its great wealth through the good management of the Doctor. I have no space for this interesting history, and must pass it. By forecast and wisdom in the management of these great educational interests, the memory of Dr. Nott ought to be kept green in all time to come by the people of this State.

While Dr. Nott was not a man of profound learning, he was an orator of commanding eloquence. It was not so much the *matter* of his discourse as the *manner* in which he said it. There was a freshness and sparkle in his style which captivated his hearers. Although his blade was double-edged and trenchant, he

could wreath it with flowers and play with his antagonist; or, if necessary, he could send it crashing through helmet and cuirass.

The oration which gave Dr. Nott a national reputation was his eulogy on the death of Alexander Hamilton, delivered at Albany in 1804. Hamilton was the idol of the American people. He had been of great patriotic service in securing our national independence. He was Washington's right-hand man, the gallant officer, the distinguished patriot, the great financier. He had fallen in an ignoble duel with Aaron Burr. The nation was in tears, as it was, last year, by the tragic death of Garfield. Funeral orations were pronounced from forum and pulpit, in all the leading cities of the land. It was a great theme. An immense audience of the citizens of Albany, without regard to party, assembled to hear the great clergyman. Dr. Nott was in sympathy with the occasion. He was a warm personal friend of Hamilton and admired his genius. From a few hastily prepared notes to guide his thoughts, he poured forth one of the most masterly orations of his life. The effect was electric. The audience was convulsed. Indignation and sorrow alternated—sorrow for the nation's loss, and indignation toward the assassin. The system of duelling was denounced, the value of human life exalted. A friend of mine was present, and such, said he, was the effect upon him, that he hardly knew whether he was in the flesh or out.

The Doctor, afterward, wrote out his oration for the press. It was a mistake. It is the skeleton, without the animating presence of the orator. The Doctor, it is said, afterward regretted its publication.

Dr. Nott could never call a student by name; but yet he knew every man by his *walk*; and *one* man he knew by his *run*. Lathrop had been down to the hotel to see some friends, and returning late in the evening and passing by the Doctor's door, was surprized by the Doctor's suddenly coming down the steps. Lathrop started upon a run and the Doctor set out in pursuit. Turning round the corner by the south colonnade, they had it "nip and tuck." Down the walk to the garden they went at a break-neck pace. Lathrop was muscular and long-winded; but by the dexterous use of his longer legs, the doctor was evidently



gaining upon his competitor, when Lathrop put into the garden, and running among the evergreens, escaped. The next morning, Lathrop was summoned to the Doctor's study. "Well, my son," said the Doctor, "we had a nice race, last night." "Yes," said Lathrop, "I didn't know, Doctor, there was so much speed in the old horse!" An explanation followed, and Lathrop was advised never to run without cause.

Many instances of Dr. Nott's power over masses of excited men might be given. One must suffice. Soon after our leaving college, a serious difficulty sprung up between the college students and the roughs living in the suburbs of the city. Some of the boys had been roughly handled. The spirit of retaliation was aroused; and what, at first, was but a spark, soon kindled into a flame. War was declared. The students taking advantage of the absence of Dr. Nott, armed themselves with guns, clubs and pistols, and formed themselves into line in front of the college buildings in readiness to march on their bloody fray. The professors expostulating in vain, finally ordered them to their rooms. This only kindled their ire and stimulated their courage. Disperse they would not, fight they would. Becoming turbulent and insulting to the college authorities, they set out upon their perilous march to avenge their insulted honor. Dr. Nott, who was in Albany, had been notified of the condition of things, and taking the first train, arrived in time to meet the belligerents on their way to the battlefield. Expressing no surprise, he quietly asked what was up? We are going to fight the "niggers," said the captain; they have insulted us, and we'll stand it no longer. Entering at once into sympathy with their plan, he told them they were right; that it would be cowardly and degrading to submit to such repeated instances of provocation; but at the same time informed them that there was policy in war, that he would espouse their cause, provided they would listen to his advice. Yielding a ready compliance, they asked him to take the matter into his own hands. With ten of your party, I can whip an army of roughs. "Do it, do it," was the ready reply.

Selecting the leading spirits of the party and giving their arms to the other boys, he said "take these weapons back to college and

go to your studies." Doing as they were bidden, they marched back, while the Doctor taking command of his little unarmed band went to the spot where were gathered the opposing host ready for the fray. In confronting them, the Doctor made one of his characteristic speeches, calling attention to the smallness of his party, that they had not come to do them harm, that it was a misfortune that any unkind feeling should exist between them and his boys, that it was a mistaken idea if they thought the college boys would fight the citizens of Schenectady—they would do no such thing. He then drew a graphic picture of their importance to society, that the foundations of the business world rest on their shoulders. He pointed out the folly of neighborhood quarrels, the value of peace and good order, ridiculed the idea of throwing mud and brickbats. So completely did he obtain the mastery over them, they set up a shout of applause and declared that they were willing to live in peace. Congratulating them on their good resolutions, the Doctor and his party retired—the chasm was bridged—a bloodless victory won.

Dr. Nott was profoundly skilled in diplomacy. He was a born ruler of men. For years the State Legislature was under his control. I don't know that he ever abused this power, unless it was in the instance I am about to relate. He was a trainer of politicians. William H. Seward, John C. Spencer and many others were instructed by the Doctor in statescraft. He was always consulted in cases of political emergency. When the Trustees of Union College tried to get a little official power, for the Doctor had it all, for the sake of keeping it he circumvented the Trustees by introducing a bill asking the Legislature to continue to the Trustees all the power they ever had. It was a lengthy document and most skillfully drawn up. It was mostly devoted to the importance of opening a street in the suburbs of Schenectady, and toward its close, the jewelled sentence that the Trustees of Union College have the same power they always had had (which was none at all), was hidden in the voluminous mass. The members of the Assembly had tired of the reading and were willing that *the street* and fifty others if desired, should be opened, and so passed the bill, and the little Trustee-clause with it.



Dr. Nott, in one of his lectures on Kame's Elements of Criticism, said to us, "Young gentlemen, never yield to anger. When a boy, I learned the folly of that weakness. I was trying to drive some unruly cattle, and became greatly enraged and vented my wrath in very unbecoming language. On looking around, I saw some of my young lady acquaintances who were enjoying the fun at my expense. I was mortified, and vowed that I would never make a fool of myself again. It will not do in any department of professional life to lose your temper; for by so doing, you put a weapon into the hands of your adversary, and your power is gone."

As a presiding officer over popular assemblies, Dr. Nott had no superior. Dignified in person, and courteous in manner, he won the admiration of all. His sympathies were always with the unfortunate. He leaned to the side of mercy. In the famous trial of Hooper Cumming, before the Presbytery of Albany, in 1817, for intemperance and plagiarism in having preached one of Dr. Channing's sermons, Dr. Nott was Moderator. But, notwithstanding the provocation he had received from Mr. Cumming, who had preached two of the Doctor's sermons in Schenectady, the Doctor being present, he did what he could at the trial to diminish the prejudice against the accused and save the eloquent preacher. Dr. Nott was interested in several mechanical enterprises, invented a stove for the burning of anthracite coal, also a new form of steam boiler for the propelling of boats. But in the latter, he met with no very great success. In his management of young men, there was this peculiarity in his instructions. He would preserve every man's individuality. Each thought and acted for himself, so that on all public occasions there was a charming variety of individuality in their orations.

The following item was obtained from a little book written by a lady: "On his seventy-sixth birthday, June 25, 1849, a committee of the senior class waited on him, requesting permission to have a general college celebration of his birthday. At this, he seemed much surprised, and asked, "How in the world did you learn that?" "Really, I did not know it myself; but if it be so, boys, that I am another year older, and you wish to celebrate it,

you must do it in the way I am going to—work with all your might.” But, said they, “we would like to illuminate the college.” “Illuminate the college!” said he, “why, what an idea! such a thing was never done.” “Why, yes,” said the students, “the first year you came here it was illuminated.” “Not hardly,” said the Doctor, “for I remember rightly, we had no college to illuminate.” But, said they, “they hung the lamps in the trees, which meant the same thing.” So the dialogue went on, and at last terminated by the Doctor’s consenting to let the senior class come to his house in the evening, for an informal levee, specifying that they should all go home precisely at 10 o’clock. Many presents were sent in. The professors and their ladies, the tutors and other officers of the college were present at the party. The Doctor was in fine spirits, entertaining the groups who thronged about him with vivid delineations of the master spirits of the last generation, with most of whom he was intimate.

Just before the company dispersed, the venerable Doctor referred in a touching manner to the separation that would soon take place between the teachers and the class before him, and besought them to live in constant reference to the judgment day, to prepare for which all other days are given. And thus in behalf of all present, offered an effecting and solemn prayer to the Father of all mercies.

The most notable event in Dr. Nott’s connection with the college was the fiftieth anniversary of his presidency, which was celebrated with great interest by the Alumni, July 25, 1854. Many of Union’s most distinguished sons took part in the festival. An Historical Address was delivered by Wm. W. Campbell; then, a discourse of great power by Francis Wayland, President of Brown University, on “The Education demanded by the people of the United States;” then followed an address of great tenderness by Dr. Nott, in his best manner. It was replete with reminiscences of the past.

“Surely,” said he, “our lives have fallen in pleasant places, we have a goodly heritage.” “But where are the actors in these scenes of glory?—the men who achieved these semi-centennial triumphs?—especially those of the Empire State?—where are the

statesmen?—where is Jay, and Clinton and Hamilton—statesmen of imperishable memory?”

“Where are the jurists?—where is the stern and incorruptible Spencer, the erudite, guileless Kent, and the eloquent and persuasive Van Ness?”

“Where are the inventors and the patrons of inventors?—where is the liberal and enlightened Livingston?—the ingenious and successful Fulton?—and above all, where is the unhonored and forgotten Fitch, the real and unrivalled author of steam-navigation?”

“Where are the men that presided over this institution in its early infancy?—where is the devout and impassioned Smith?—the acute and polemic Edwards?—and where the elegant and accomplished Maxey?”

“Where the teachers that constituted its faculty?—where is the profound Van Der Huval?—the beloved Taylor?—the devoted Yates?—the learned Allen, and the venerated Davis?”

“Where are the men that constituted its Board of Trustees?—where is Van Rensselaer, and Banyar and Henry, and Outhout and Yates and Duane? and especially where is Romeyn and Coe and Blatchford?—venerable names. Where? Gone—all gone; and I stand here alone to-day among you, beloved pupils, the last remaining relic of a former age, as the leafless, storm-stricken forest tree stands amid trees of younger growth, still spreading around their branches, beating the storm and rejoicing in their strength.”

Venerable old man! “The leafless forest tree” has fallen; its ashes have mingled with the dust of other centuries; but the memory of its departed glory remains, a joy and benediction forever.

The standard of teaching in the college was low. With few exceptions, the professors were easy and inefficient. All the life was in two of the younger men—Chester Averill and Isaac W. Jackson. Averill was a man of uncommon promise. He was tall and beautiful in person, clear and comprehensive in intellect, diligent and untiring in study, lofty and aspiring in his ideals of perfected manhood. In 1836, in the midst of his scholarly career, he was cut off and consigned to an early grave.

Prof. Jackson died in 1877. He was a man of rare mental abilities, of large mathematical culture, of broad and comprehensive views, of quick and delicate sensibilities, and of noble and generous impulses.

In this connection, I should not omit the name of Bishop Alonzo Potter, who had joined the college faculty during our last year and wished to reform the lax discipline of class-instruction; but did little before our graduation. The task of moving the inert mass was too herculean for a man of even his acknowledged power and reputation.

Dr. Nott did not rely so much upon book-learning as upon the knowledge of human nature. He cared little for libraries and cabinets of natural history; with him, book-worms and pedants were at a discount. He would have every man rely upon his genius and not consume his strength with the wasting midnight oil. He liked *readiness* and not a *plodding* scholarship. Here, there was no encouragement of painstaking fidelity to scholastic duties. The boys were left to follow their own inclinations, and these in the average student are not of a very elevated character.

The Doctor said in class, one day, that he was not afraid to meet a man in argument who had read all the books of a large library, but he did fear him who had read but one. He advised us to confine our reading during senior year to Shakespeare and the Bible.

In our class of seventy-five graduates (there were then eighty in attendance), twenty-seven became lawyers, twenty-three clergymen, six physicians, four teachers, the rest farmers and business men. For intelligence, usefulness and success in life, it will challenge comparison with any class which has left the college. And, I think it may be said with truth, that the graduates of Union College will bear favorable comparison with those of any of the leading institutions in the country. The triennial catalogue presents an array of distinguished names in every department of human learning. I have selected a few; among lawyers, John Savage, Egbert Bensen, Francis Van Vecten, John C. Spencer, Robert J. Breckenridge, William H. Seward, William Kent, Richard M. Blachford, Ira Harris, John A. Lott and Alexander W.

Bradford. Among clergymen, are Thomas C. Brownell, Thomas McCauley, Thomas T. De Witt, Alonzo Potter, George W. Doane, Horatio Potter, Leonard Woods and Ichabod S. Spencer. Among teachers and college presidents, are found T. Romeyn Beck, Francis Wayland, Taylor Lewis, Stephen Alexander, Henry P. Tappan, John W. Raymond, Silas Totten, John B. Beck, Amos Dean, Lawren P. Hickok, Lewis C. Beck, George W. Eaton, Chester Averill and I. W. Jackson. Many others might be named.

Do you remember how inexpensive our education was? The whole expense of mine was \$342.61, and I lived like a prince! The best of board for \$1 to \$1.50 per week. The greatest expense was for tuition, \$18.50 per term; for repairs and damage, 62½ cents. The whole annual expense for tuition was \$57.37½! Compare this with the present scale of prices for college tuition. But money had a greater value in those early days of the Republic; and of course, had a greater purchasing power. The mines of California had not been discovered!

Time has wrought many changes. The Republic has laid aside its swaddling clothes and reached a vigorous manhood. We have witnessed its unfolding greatness. We have joined the long procession in its triumphant march.

Fifty years have passed! What changes have been wrought in human society! No fifty years in the world's history have witnessed such mighty revolutions! Turn your thoughts upon our country. The population of the United States in 1835 was 14,786,000. In 1880, it was 50,155,783. In 1832, there were 24 States; in 1882, there are 38 States and 7 territories. In 1830, there were only 23 miles of railway; in 1882, there are more than 107,000 miles! The first railroad in the United States was at Quincy, Mass., running from the quarries to the Neponset river by horse power. The first railway in the country on which steam power was used was a short line built in 1827 by the Delaware and Hudson Coal Company, from their mines to Honesdale, Pa. This road was used for traffic and not for passenger trains. In 1829, Horatio Allen, of the Novelty Works, New York, brought from England the first locomotives, one of which was used on the



Delaware and Hudson railroad, but was taken off because it was too heavy for the rails. This engine was built by George Stephenson, the English engineer, who was not the originator of the railway, nor the inventor of the locomotive. The first railroad, of which I can find any account, was the Darlington road, built in 1818 by Mr. Pearce, which run from the river Tees to the collieries, west of it. After a hard struggle, an act of Parliament was obtained for it. The road at first was only 30 miles long; it was afterwards extended 130 miles, but was not open for use till September, 1825.

It is said that the first American locomotive was built by Peter Cooper, in 1830, called "Tom Thumb," which was placed on the Baltimore and Ohio railroad; but was too small to be of any practical service. The object of its construction was to demonstrate the practicability of turning short curves. But, in the same year, 1830, a locomotive was made at the West Point Foundry for the South Carolina road, called the "Phoenix;" a second, was called the "West Point." In the spring of 1831, the third one built for the Mohawk and Hudson railroad from Albany to Schenectady, was called the "De Witt Clinton."

While we were in college, the Mohawk and Hudson Railway was built; and, in our afternoon excursions, we used to visit the grounds and witness the progress of the work. This railway was begun in August, 1830, and finished in September, 1831. Surveys were first made by Mr. Fleming in 1829, who was succeeded by Mr. Jarvis in 1830. Passengers were taken upon this road in coaches drawn by horses and by the locomotive engines, the "DeWitt Clinton," to which reference has just been made, and the "Robert Fulton," an English engine. The coaches were built like the common post coaches of that day, and would carry inside and out about twenty passengers, each. We were among the very first to make a trip to Albany and rode on the outside; the cars being drawn by horses. These engines as compared with the mammoth locomotives which now run over the same road, were mere philosophical toys. The "De Witt Clinton" was only about eleven and a half feet in length, and mounted on iron wheels of four feet eight inches diameter. There were two cylinders, one on each



side of the engine, of five inches and a half diameter and sixteen inches stroke. The power of the engine was about ten horses. As it stood on the rails it could be easily moved by a single hand. Its weight was 6,758½ pounds. The "Robert Fulton" weighed 12,742 pounds, of which 8,745 pounds rested on one pair of wheels. The former was as long as that of the "De Witt Clinton," and was mounted on wooden wheels, strongly bound with iron. Mr. Stephenson said of it: "As to the power of this engine, it would take twenty tons without difficulty; but with twelve, it will be much better. The small inclination of one foot in two hundred and twenty-five, will affect the motion of the engine very little." These were days of small things! It was impossible to draw a train of cars with this engine up the slight grade at Schenectady. A stationary engine did that work, which with the one at Albany ate up the profits of the road!

The comparative merits of English and American locomotives may be seen in the following reference. On the railroad between Alexandria and Suez, there were four locomotives in 1858, two of which were English and two American, made at Taunton, Mass. The American engineer told the Pasha that instead of being weak, as the English had said, he would haul as many loaded cars as would reach from one end of the road to the other. The Pasha, to try it, had all the cars he had, seventy-five of them, heavily loaded and his own car hitched behind. The American locomotives hauled the whole of them *two hundred miles to Suez in twelve hours*, stopping for fuel and water. This done, the Pasha cried, "God is great—a Yankee is very near perfection." After that, the Pasha used the Taunton engines altogether.

The first railway built in Spain was between Barcelona and Mataro, and it was opened in 1848. Now, Spain has 4,841 miles of railway, 1,310 in course of construction, and 1,008 miles authorized.

At the present time, the United States has two or three thousand miles more railway than all the countries of Europe combined can show.

The capital stock of all the railroads in the United States were, January 1, 1881, \$2,553,734,117. All parts of the Union have

been linked together with iron bands ; the Atlantic and Pacific Oceans, the Gulf of Mexico and the great Lakes of the North, have been indissolubly united.

An enormous increase has been made to the territory of the United States. The acquisition of New Mexico, nearly all of Arizona, California, Nevada, Utah and part of Colorado was due to the war with Mexico which ended in 1848. That portion of Arizona lying south of Gila river was bought of Mexico in 1853 ; and the purchase of Alaska from Russia in 1867, was the last addition to the territory of the Republic.

The mining of coal, iron, lead and the precious metals has reached since our graduation, an unprecedented degree in the scale of values. On this topic, I have only time to say, that it was estimated by the director of the Mint for the year ending June 30, 1880, at \$80,167,000 ; of which \$33,522,182 was gold ; \$40,005,364 silver ; \$5,742,390 lead. Prior to the discovery of California, the total product of gold and silver was very small. But in 1848, the working of the California mines began, and from 1861 the quantity of precious metals has been constantly increasing. At present, the United States produces a larger quantity of those metals annually than any other country of the world.

In this connection, I will call attention to one of our cereals—wheat. The wheat crop of the United States for 1880, was 153,252,795 bushels, which was valued at \$190,546,365 ; more than twice the value of all the gold, silver and lead, for the same year, while the money value of the hay-crop of the United States is many times that of the wheat-crop.

The following table will show the marvellous growth of some of our American cities, during the past fifty years :—

CENSUS OF 1880.		CENSUS OF 1830.	
New York,	1,206,590	202,589	
Philadelphia,	846,984	161,410	
Brooklyn,	566,689	15,396	
Chicago,	503,304	A prairie.	
Boston,	362,538	61,392	
St. Louis,	350,522	6,694	

Baltimore, . . . . .	332,190 . . . . .	80,621
Cincinnati, . . . . .	255,708 . . . . .	24,831
San Francisco, . . . . .	238,956 . . . . .	Not settled.
New Orleans, . . . . .	216,140 . . . . .	48,310
Cleveland, . . . . .	160,142 . In 1840, .	671
Pittsburgh, . . . . .	156,381 . . . . .	12,668
Buffalo, . . . . .	155,137 . . . . .	8,653
Washington, . . . . .	147,307 . . . . .	18,827
Newark, . . . . .	136,460 . . . . .	10,955
Louisville, . . . . .	123,645 . . . . .	10,341
Jersey City, . . . . .	120,728 . . . . .	1,025
Detroit, . . . . .	116,342 . . . . .	2,222
Milwaukee, . . . . .	115,518 . . . . .	Settled in 1835.
Providence, . . . . .	104,850 . . . . .	16,832
Albany, . . . . .	90,903 . . . . .	24,238
Rochester, . . . . .	89,363 . . . . .	296
Alleghany, Pa., . . . . .	78,681 . . . . .	Not settled.
Indianapolis, . . . . .	75,074 . . . . .	Not settled.
Richmond, . . . . .	63,003 . . . . .	16,062
New Haven, . . . . .	62,782 . . . . .	10,180
Lowell, . . . . .	59,485 . . . . .	6,474
Worcester, . . . . .	58,295 . . . . .	4,172
Troy, . . . . .	56,747 . . . . .	11,405
Kansas City, . . . . .	55,813 . . . . .	Not settled.

I must not dwell longer on this national growth and prosperity. The intellectual, moral and æsthetic progress of the Republic, though not commensurate with her amazing material development, has, nevertheless, been creditable. The cause of education has made rapid advances. The Common School system, which originated in New England, has been successfully introduced into the Southern and Western States. More than 7,000,000 children attend the free schools and are taught by more than 200,000 teachers. Many thousands attend private schools and academies. There are in the country 369 colleges, 93 theological seminaries, 88 medical schools, 28 law schools, 81 normal schools, 235 female seminaries, and 1251 academies. Of the colleges, Ohio has 34; Illinois, 28; California,

12; Massachusetts, 7; New Jersey, 4; Maine, 3; Vermont, 2; Rhode Island and New Hampshire, each 1. Of the female seminaries, Kentucky leads, she has 23; Tennessee, 17; Virginia, 14; Massachusetts, 10; Maine, 2; New York, 15; Ohio, 12; Vermont, 1. From the greater comparative number of institutions in the West, a stranger might conclude that the enlightenment is greater, or the ignorance of the people is denser, than in the East. The multiplication of colleges in a State is a mistaken policy. One or two well-endowed colleges serve the cause of the higher education of the people better than a score of feeble and half-equipped institutions.

Excuse a personal reference. It was in 1839, at Rutgers Institute, I began my labors as a teacher of girls. Ample means were placed at my disposal to organize a system of female education such as had not been attempted in this or any other country. I was young and ready for work. Little had been done for the higher education of woman. Nothing of a public character. It was a prevailing opinion that woman could not master the abstract sciences. True, Maria Gaetana Agnesia had published her "*Istituzioni Analytiche*," and in consequence had been installed professor of mathematics in the University of Bologna; Mary Somerville had published her first work, a summary of the *Mécanique Céleste* of La Place under the title of "*Mechanism of the Heavens*;" Miss Carolina Herschel had aided her father and distinguished brother in their astronomical researches; but these were exceptional cases. In our most distinguished schools for girls, it was thought sufficient if the elements of algebra and geometry were taught. Little was done in chemistry, or physics. Emma Willard, of Troy, had organized a popular seminary which was the model school of the day. But, it was confined to elementary instruction in common school branches, belles-lettres, and music. It attempted nothing higher. It was a school of polite learning for the drawing room. It taught the graces and accomplishments of refined society. All admirable in their way and deserving of imitation. It is absurd to regard learning and good breeding as incompatible. Coarse manners and ignorance usually go together. Mrs. Willard's was a pioneer school and did a good

work. In many quarters, this limited system of instruction was thought sufficient; that it was idle to attempt anything higher.

The question with me was, can anything better be done? Can girls be taught to grapple with the difficulties of abstract science? Can they study the higher mathematics? Can they comprehend a long sustained argument in ethics or philosophy? I laid my plans which required time to mature. I prepared an extensive curriculum with the exception of the Greek classics, a *college course*. Its introduction was difficult. My teachers and pupils were not prepared for it. My teachers' knowledge was limited to the elements of algebra and geometry. By degrees, I introduced the study of solid and analytical geometry, plain and spherical trigonometry and the higher algebra. The pyramid was finally crowned with the differential and integral calculus. The course, in fact, was similar to that of the military academy at West Point. In consequence of the undisciplined minds of my pupils, at the beginning, it took several years for the perfect running of the system. Success was finally attained. My classes were examined by college professors of mathematics, whose printed reports are a guarantee of all I claim, viz., that woman can and did excel in the higher walks of learning.

The wisdom of such an education for the majority of girls may be questioned. I have since modified the course by leaving out the calculus and adapting it to the requirements of what will be more useful, substituting the study of the Fine Arts—their history and philosophy—giving thereby a more symmetrical education to the future women of Society.

For teaching practical chemistry, a laboratory furnished with expensive apparatus was built. The young ladies put on their aprons, and experimented for themselves—a novel sight in those days! A valuable library and cabinets of natural history were collected. But I need not enlarge. The point I wish to establish is this, that Rutgers Female College of New York is the *originator* of the college system of education for women in this country.

Much has been written on the history of education. One of the most voluminous writers was Prof. D. Buddingh, of the Royal Academy of Delft. But, as his works in many volumes were



written in Low Dutch, they are little known. The time, I think, has not yet come to write the philosophy of education. The views of educators are so diverse, their systems of instruction so varied, it will be necessary to wait before the true philosophy can be written. Herbert Spencer published an interesting treatise on the subject. He begins with the enquiry, "What knowledge is most worth?" Under this head, are the following topics: "The ornamental precedes the useful." "The need for a standard of value." "The purpose of education." "Classification of our activities." "The order of subordination of subjects." "The rank of æsthetic culture." "The fine arts based on science." "Science itself poetic." "Studies best adapted to discipline." "Religious influence of science."

We have not space for even a summary of what he says on each of these topics. His conclusion is, that *science* is of most value—for the maintenance of life and health—for that indirect self preparation which we call gaining a livelihood—for the due regard of parental functions—for that interpretation of national life, past and present, without which the citizen cannot rightly regulate his conduct—for the most perfect production and present enjoyment of art in all its forms, and for purposes of discipline—intellectual, moral and religious science is the *sine qua non*.

He concludes by saying: "Science is the household drudge, who, in obscurity hides unrecognized perfections. To her has been committed all the work; by her skill, intelligence and devotion, have all conveniences and gratifications been obtained; and while ceaselessly ministering to the rest, she has been kept in the background, that her haughty sisters might flourish their fripperies in the eyes of the world. The parallel holds yet further. For we are fast coming to the *denouement*, when the positions will be changed; and while those haughty sisters sink into merited neglect, science, proclaimed as highest alike in worth and beauty, will reign supreme."

The public press has become a powerful engine in society—a power in forwarding civilization and elevating man, which is increasing every year. The number of periodicals issued in the United States, is about 6,000. There are 548 papers which print

more than 5,000 copies each issue, and eleven which print more than 100,000 copies. The whole number of copies of newspapers printed annually exceed one billion. The number of books published in the United States averages 3,000 a year. Among the great editors and pioneers, were William L. Stone, James Watson Webb, William Cullen Bryant, Horace Greeley, Henry J. Raymond, James Gordon Bennett, Thurlow Weed, and many others. There are a large number of public and private libraries, some of which contain from 50,000 to 100,000 volumes, each. Many of them are rich in manuscripts and printed books, embracing the entire range of universal learning. The fine arts have received praiseworthy attention. Although our architecture has not reached the high standard of the European renaissance, yet there has been a progressive improvement in fitness, convenience and comeliness. The art of music has made the greatest advance. In no country in Europe is there a greater interest taken in orchestral, operatic and sacred music than in this country. It has become an essential accomplishment in a refined education. The pictorial and plastic arts are largely cultivated. Large sums of money are expended by our citizens of wealth in forming art galleries of paintings and statuary. Large and numerous collections of engravings and etchings are found in private dwellings, as well as cabinets of costly ceramics of all countries. Cooking has, to some extent, become a fine art. A more refined civilization in the matters of food and clothing is seen in our households. The only danger is, that it may run into extravagance and dissipation. But, if kept within proper limits, it will add much to the longevity and happiness of our people. The stomach and brain are sympathetic. The former supplies the material for the generative forces of the latter. They are automatic.

Allusion can only be made to the following great historical facts of the half century:

Daguerre's Discovery in 1839. Talbot's paper photography, same year. Unveiling of the interior of Africa by Livingstone (1840), Speke, Stanley and others. War of the United States with Mexico (1846). Mormonism established in Utah, 1847.

Discovery of gold in California in 1848, and the consequent settlement of States on the Pacific Coast. The settlement of Australia by English speaking people in 1850. Discovery of the Northwest Passage by McClure, 1851. Opening of Japan, 1853. Crimean War in 1854, and death of Nicholas, March 2, 1855 — Serf-Emancipation of 23,000,000, by Alexander II. and the Russian Liberals, in 1861. The great American Civil War, 1861. Lincoln's Emancipation Proclamation, 1863. The Franco-Prussian War, 1870—The Unification of Italy, and the end of the Pope's Temporal Power, 1870. Russo-Turkish War, 1877. The Circumnavigation of Europe and Asia by Nordenskiöld in the *Vega*, 1879—Discovery of Oxygen in the Sun, by Henry Draper, 1877. On the 23d of April, 1838, the steamship "Sirius" arrived at New York, the first ocean steamer from England. A few hours later of the same day, arrived the "Great Western," which had left Liverpool four days after the "Sirius."

The excitement caused by the arrival of these steamers was very great. Multitudes went to see them. Two or three years later, I saw Daniel Webster and his daughter leave for Europe on board the "Great Western." A great advance had been made in steam navigation. Fulton's first boat began running between New York and Albany, 1807. Three years after, a writer living in a country house on the Hudson, wrote:

\* \* \* "One of the curiosities that we daily see pass under our windows is the steamboat, a passage vessel with accommodation for near a hundred persons. It is moved by a steam-engine turning a wheel on either side of it which acts like the main wheel of a mill and propels the vessel against wind and tide at the rate of four miles an hour. As soon as it comes in sight there is a general rush of the household to watch and wonder until it disappears. They don't all know what to make of the unnatural monster that goes steadily careering on with the wind directly in its teeth as often as not. I doubt that I should be obeyed were I to desire any one of them to take a passage in her. When first this vessel appeared in these waters it excited great consternation. Some of the simple country folks were pretty well frightened out of their wits, suspecting, I am told, it was some diabolical conveyance that had

brought his Satanic Majesty from the lower realms to visit the United States. I am inclined to look with favor on this application of the propelling power of steam. Not improbably it is destined at no distant day to produce incalculably great and beneficial changes in our mode of voyaging."—*Notes and Queries*.

I cannot pass in silence the marvellous scientific discoveries which have been made since we left college, nor can I do them justice in the limited time at my disposal.

The purely scientific knowledge we possess was discovered almost entirely by means of original research. It is either by observing matter and its forces under new conditions or from a new aspect, that nearly all discoveries are made. Some discoveries are made by observing the phenomena of bodies placed under special conditions by those operations of nature over which we have little or no control. All our knowledge of astronomy and much of that of geology and physiology, was acquired in this way. Nearly all modern discoveries of importance in physics or chemistry, require long and difficult investigations to be made, in order to completely establish their truth. Scientific discovery is the most valuable in its ultimate practical results when it is pursued from a love of truth as the ruling motive, and any attempt to make it more directly and quickly remunerative by trying to direct it immediately to practical objects, decreases the importance of its results, diminishes the spirit of enquiry, and sooner or later reduces it to the character of invention. The greatest practical realities of this age had their origin in a search after important truths, entirely irrespective of what utilities they might lead to.

Many persons scarcely know the difference between science and art; a still greater number cannot readily distinguish between a concrete science and a pure one; and nearly all persons confound discovery with invention. A science may be conveniently defined as a collection of facts and general principles which are to be learned; an art as a collection of rules which are to be followed. Art therefore is applied science; and every art also has a basis in science, whether that basis has been discovered or not. Scientific



principles underlie not only manufacturing processes, but also sculpture, music, poetry and painting.

When Oersted first observed a magnetic needle in proximity to a body through which a current of electricity was passing, had a tendency to place itself at right angles to such body, or more strictly speaking to rotate round that body; and when Henry and Sturgeon discovered that if currents of electricity pass around a bar of soft iron, the iron becomes temporarily magnetic; and when in that magnetic condition it powerfully attracts to it any pieces of soft iron which may be near it; and when by the discoveries of Carlisle, Nicholson and Davy, that when a current of electricity passes through certain chemical substances, those substances are thereby decomposed, or new compounds are found, each made a scientific discovery. But when Morse applied those discoveries in the construction of his telegraph, which he first set up between Baltimore and Washington, he made an invention. In discovery, we search for new phenomena, their causes and relations; in invention, we seek to produce new effects, or to produce known effects in an improved manner.

"There is nothing on earth so small that it may not produce great things." The most abstract and apparently trivial experiments in original research have in some cases led to inventions and results of national and even world-wide importance. The contractions of a frog's leg in the experiments of Galvani, and the movements of a magnetic needle in those of Oersted, have already led to the expenditure of hundreds of millions of dollars in laying telegraph wires all over the earth, and to an immense extension of international intercourse. But the original experiment of Oersted was not discovered without labor; it was only arrived at after many years of research.

The laws of the mechanical action of conductors conveying currents upon magnets and upon each other were investigated by Ampere in a series of experiments, which were at once conclusive and exhaustive.

Michael Faraday discovered magnetic electricity in 1831. His valuable contributions to physical science, in his researches



into the phenomena of electricity and magnetism, will always be acknowledged.

Previously to the experiments of Faraday, the *induction* of electric currents was unknown. Faraday, in the first series of his experimental researches, describes an experiment in which a copper disc was made to rotate between the poles of an electro-magnet, while one electrode of a galvanometer was connected with the axis of the disc and the other with a wire which was held in contact with the edge of the disc, which edge was amalgamated to secure a good connection. On spinning the disc, a current was immediately obtained, the direction of which was reversed with that of the rotation. This experiment may be regarded as the starting-point of the dynamo machines of Wilde, Gramme, Siemens and others, which seem destined to play so important a part in the civilized life of the future.

Faraday also showed that where two circuits are placed near to one another, if a current be started in one circuit, there is an instantaneous current produced in the *opposite direction* in the neighboring circuit; while, on stopping the primary current, a transient current in the same direction as the primary occurs in the other or secondary circuit. This experiment was the origin of the now well-known induction coil. Again, when the current was flowing steadily in the primary circuit, if the secondary circuit were brought near to it, a current was *induced* in the secondary in the direction opposite to that in the primary, and continued during the approach of circuits. On removing the secondary circuit, a transient current was set up in the same direction as that in the primary.

The telephone is a beautiful example of the application of this law of induced currents. Every movement of the magnetic disc in front of the pole of the magnet alters the number of magnetic lines of force passing through the coils of wire surrounding the pole, and hence induces a current in one direction or the other in the coil, which current, increasing or diminishing the strength of the magnetism in the receiving telephone, causes a corresponding motion in the iron disc of the receiver, which, therefore, emits sounds similar to those incident upon the receiving instrument.

The determination of the laws of self-induction in electric currents is another of Faraday's many contributions to electrical science. If the poles of an electro-magnet be joined by a wire of great resistance, as well as by the battery, when the battery is removed, a considerable current will flow through the wire. This current Faraday called the *extra-current*. It is more generally referred to as the self-induction current.

There is a well-known experiment of Faraday, in which a specimen of his heavy glass, or borate of lead, was placed between the poles of a powerful electro-magnet, and a beam of plane polarized light was passed through the glass in the direction of the magnetic force. Faraday found that, when the light passed from the north to the south pole of the magnet, the plane of polarization was turned through an angle in the same direction as a right-handed screw would rotate if piercing a solid and advancing with the light. When the light passed in the opposite direction, the rotation of the plane of polarization was in the same direction with respect to the magnet, and therefore reversed with respect to the path of the light. In this respect, the heavy glass under the influence of the magnet behaved differently from a solution of sugar, which always turns the plane of polarization of the light in the same direction with reference to its direction of transmission. This was the first experiment which showed any relation between light and magnetism, and indicated that the medium which serves as the vehicle of light—the luminous ether—must at least be affected by the presence of magnetic force, though the fact that the presence of ponderable matter is necessary to the production of this rotation, and that the direction of the rotation depends on the nature of the matter, renders it doubtful how far magnetic force affects the ether directly.

All transparent solids and liquids exhibit the same action on light in different degrees. If a tube of water, with plate glass rods be placed within a coil of wire through which an electric current is passing, and plane polarized light be transmitted through the tube, the plane of polarization will be turned through an angle in the direction in which the current circulates, and this angle can be proportional to the current.

In 1846, Faraday received the Royal and Rumford medals for his discourses on dia-magnetism and on the influence of magnetism upon light, respectively. In 1847, he declared the magnetic character of oxygen and the magnetic relations of flame and gases.

In this same line of investigation we find our own countryman, Joseph Henry. In 1827, he began his investigations in electricity. In 1838, his "Contributions to Electricity and Magnetism" were published. His scientific papers were published in *The American Philosophical Transactions*, *Silliman's Journal*, and the *Journal of the Franklin Institute*.

He made several thousand original investigations in electricity, magnetism and electro-magnetism, which were never published. He is the undisputed inventor of the electric telegraph. In 1825, Mr. Barlow of the Royal Military Academy declared that the telegraph was impossible. In 1830, Prof. Henry had a telegraph in working order of a mile and a half in length. It is to be understood, however, that the telegraph is the result of many scientific laborers from Oersted through a long series of years; and that Henry supplied the missing link in the perfected chain by first rendering it applicable to the transmission of mechanical power, and by first actually magnetizing a piece of iron at a distance, and by it to deliver telegraphic signals. He also showed what kind of battery must be employed to project the current through a great length of wire, and what kind of coil should surround the magnet used to receive the current and do the work.

The following are the main points in the order of discovery which led to the electro-magnetic telegraph. They are condensed from Prof. Henry's statement before Congress.

1819-1820. Oersted showed that a magnetic needle is deflected by the action of a current of electricity passing near it.

1820. Arago discovered that while a galvanic current is passing through a copper wire, it is capable of developing magnetism in soft iron.

1820. Ampère discovered that two wires through which currents are passing in the same direction attract, and in opposite directions repel, each other; and thence he inferred that magnetism consists in the attraction of electrical currents revolving at right

angles to the line joining the poles of the magnet, and is produced in a bar of steel or iron by induction from a series of electrical currents revolving in the same direction at right angles to the axis of the bar.

1820.—Schweigger produced the galvanometer.

1825.—Sturgeon made the electro-magnet by bending the bar, or rather piece of iron wire, into the form of a horse-shoe, covering it with varnish to insulate it with a helix of wire, the turns of which were at a distance.

1829–1830.—Henry, in accordance with the theory of Ampère, produced the intensity or spool-wound magnet, insulating the wire instead of the rod or bar, and covering the whole surface of the iron with a series of coils in close contact. He extended the principles to the full by winding successive strata of insulated wire over each other, thus producing a compound helix formed of a long wire of many coils. At the same time he developed the relation of the intensity magnet to the intensity battery, and their relations to the magnet of quantity. He thus made the electro-magnet capable of transmitting power to a long distance, demonstrated the principle and perfected the magnet applicable to the purpose, was the first actually to magnetize a piece of iron at a distance, and to demonstrate and declare the applicability of the electro-magnet to telegraphy at a distance. Using the terminus short circuit magnet of quantity and the armature as a signaling device, he was the first to make by it acoustic signals, sounding a bell at a distance by means of the electro-magnet.

1833.—Weber discovered that the conducting wires of an electric telegraph could be left without insulation except at the points of support.

1833.—Gauss ingeniously arranged the application of a dual sign in such a manner as to produce a true alphabet for telegraphy.

1836.—Daniell invented or brought into use a constant galvanic battery.

1837.—Steinheil discovered that the earth may form the returning half of the circuit, and that a single conducting wire suffices for telegraphy.

1837.—Morse adopted, through the agency of Dr. Leonard



Gale, the principle of the Henry electro-magnet, and made of the armature a recording instrument.

1838.—Morse devised his "dot and dash" alphabet, a great improvement upon the Gauss and Steinheil alphabets.

1844.—Morse suggested and brought into use the system of relay-magnets and relay-circuits, to reinforce the current.

The last is the most valuable contribution made by Prof. Morse. This system of reinforcing the electric current improved by Thompson and others, is necessary for the transmitting of messages over great distances by land or sea. We are ready to accord all due honor to Morse for his courage and success in introducing the best system of telegraphy, surpassing in value all the European systems. Still we must remember that he who first exalted the *quantity* magnet of Sturgeon, from a power of twenty pounds to a power of *two thousand* pounds, was the absolute creator of the *intensity* magnet; and that the principles involved in this creation, constitute the indispensable basis of every form of the electro-magnetic telegraph in existence. This great honor belongs to Henry. Besides this, he was the inventor of the chronograph, of the electro-magnetic engine, and was an independent discoverer of magnetic-electricity.

It is true of both Faraday and Henry, that they cared little for the application of their scientific discoveries to the useful arts. Their chief aim was to interpret the laws of nature without regard to any higher reward than what comes from the satisfaction of enlarging the boundaries of human knowledge. Both possessed little of this world's goods, and died poor.

During nearly of the whole of Henry's scientific career, I had the honor of a personal acquaintance with him. While at Princeton, he often wrote me on scientific subjects. In 1842, he made in my laboratory in New York, a series of experiments on atmospheric electricity. Some of the apparatus he there contrived, is still in my possession.

Among the greatest of American electricians must be placed in imperishable letters, the names of Franklin and Henry.

I wish to put this minute on record, to show the noble character of Prof. Henry. When Morse applied to Congress, in



1837, for an appropriation to enable him to make a trial of his telegraph, he became the *butt* of ridicule, and was fairly driven out of Washington. He went to Europe, and, returning in 1839, renewed his importunities. The shafts of ridicule flew thicker and faster. In the estimation of Congress, he was the greatest joker of the century. Dr. John Torrey, returning from Washington, said, "It is of no use; Morse is the laughing stock of Washington; he will have to go back to portrait painting."

At this time, John C. Spencer was Secretary of War. And, wishing to know whether there was anything in Morse's invention, visited Princeton to see Henry. Henry assured him that the telegraph was *practicable*, as he could show himself by an examination of the short line he had set up in the college campus. Spencer was satisfied, and, returning, communicated his opinion to the leading men in Congress; and, as a result, the bill appropriating \$30,000 was passed, securing the honor of Morse's world-renowned telegraph to the United States, through the services of Spencer and Henry.

In 1851, the submarine telegraph cable was laid between Dover and Calais; in 1866, the Atlantic cable between Europe and America. The transmission of messages over such great distances required more delicate apparatus than had been used in communicating between stations on land. Sir William Thompson was successful in improving the apparatus. Until eight or nine years ago, the Morse system, with its printing attachment, was the only thing known. The first important improvement was the Wheatstone automatic instrument, by which greater speed was obtained by the use of chemicals. The capacity of a single wire was also doubled by the ingenuity of Stearns, of Boston. An interesting and valuable invention, chiefly due to the researches of Edison, is widely used, by which two messages can be sent in the same direction and at the same time, over one wire. It is also true, that two messages can be sent simultaneously on the same wire in opposite directions, while by the employment of the duplex system, the capacity is again doubled, thus furnishing the quadruple system now in general use on all the main lines of

telegraph in this country. To invent a cheap system of telegraphy has led to the introduction and trial of a great number of other systems with which the names of Hayes, Edison, Casselli and Mayer are associated. Later came the so-called harmonic telegraphs of Reis, Varley, La Cour, and Gray. When Wheatstone, Siemens, Halskie and Edison sought to do away with the Morse operation, real progress was made. The system of telegraphy as now carried on by the American Rapid Telegraph Company is the nearest approach to high speed and cheapness yet devised. By means of perforated paper which works automatically, the transmitting operation is gotten rid of, and at the other end, a ribbon moistened with chemicals does the work of the receiving operator. We are, I think, on the eve of a great revolution in telegraphy by the ingenious contrivances of Mr. Parcellé, of Boston. His system is called "Harmonic, Automatic Telegraphy," and differs from that in use by the Rapid Telegraph Company in two important points. The first is an improved and abbreviated construction of the alphabet. The second is the employment of a system of sympathetic resonance, by which, with the use of a single wire and unskilled operators, the same amount of work which is now done by ten wires and skilled labor can be accomplished. Thus, for the first time in the history of telegraphy, the Morse alphabet and system are done away with, as are also the translating and transcribing by receivers. Instead of requiring the ordinary handling and delay, the message, be it long or short, is rapidly prepared in a perforating machine fed into the transmitter, and is instantly reproduced in clear Roman letters on sheets of paper ready to be sent by a messenger to the party addressed. The actual number of words sent, on an average, by the American Rapid is from 600 to 700 per minute, while the lowest computations made from results obtained from an instrument only partially completed, shows a speed by the new method of 5,000 words per minute. A great advantage, too, is that, being sent over a single wire, the matter comes consecutively, and is, therefore, free from liability to error, as is often the case, where several wires are used for the sending of a single dispatch.

A new application of photography in connection with the

science of telegraphy has been made by Mr. Parcelle, in which he has succeeded in producing a combination whereby, on land lines, messages can be transmitted by electricity and recorded by photographic action. This can be done successfully at the rate of about 1,400 words per minute; the words being distinctly transcribed in plain Roman in folio form. A feature of this device is that it requires so little current, that it is as easily operated at a distance of 5,000 miles as 5 feet without relays. It is entirely automatic, and requires no supervision. The Atlantic cable is now operated by Thompson's galvanometer, by which only 13 words per minute can be sent, and requires not less than two operators at the receiving end, and even then there is great liability to mistake. The cable rates are now fifty cents per word. The new system will easily transmit and record, automatically, 300 words per minute, and the result can hardly fail of being an important reduction in the present tariff.

According to the estimates of a French statistician, the total length of all the telegraph wires at present laid is sufficient to reach forty-six times around the earth. The estimated total length of all the submarine telegraph cables in the world is 62,100 miles, and their money value is \$200,000,000.

The Telephone and Microphone are recent inventions, by which the human voice is transmitted through an electric conductor from one station to another, so that a conversation can be carried on at great distances apart. This is one of the recent marvels. Edison, Bell, Hughes, Dolbear and others, are the inventors.

The Electric Light is another gift to society. Although it has not been so perfected as to be introduced into our dwellings as economically as gas, it is believed that through the labors of Siemens, Gramme, Edison, Weston and others, success will be finally won.

Photography, with its development and applications, is a subject of marvellous interest.

The first attempts at fixing images by light were published in

the Journal of the Royal Institution of Great Britain, in June, 1802. They were made by Wedgewood and Davy.

In 1814, M. Miecce and M. Daguerre took up the subject. In 1829, they entered into partnership. The discovery of the Daguerreotype was reported to the world in January, 1839. It was at a memorable public séance in the Palais Mazarin, on the 19th of August, 1839, that Daguerre, in the presence of all the great authorities in art, science and diplomacy, who were then in Paris, illustrated his process by experiment. An Act had been passed by the French Government, which gave to Daguerre an annuity of 6,000 francs, and to M. Isodore Niepce, the son of Daguerre's partner, an annuity of 4,000 francs, with one-half in reversion for their widows.

Arago declared that "France had adopted this discovery, and was proud to hand it as a present to the whole world."

In January, 1839, six months previous to the publication of Daguerre's process, Mr. Fox Talbot, of London, made known to the Royal Society his discovery, and the next month published his process of fixing the camera image on paper, which was called the "Talbot-type." Talbot secured a patent, for which he was severely criticised. From his process is derived the beautiful *Paper Photography*, as now practiced, and the still more beautiful process for *positives* on glass. The Daguerre process has been superseded by that of Talbot. Daguerreotypes are no longer found in the market.

Daguerre taught a large number of persons from all parts of the world the process. Sachse of Berlin, a dealer in art, was initiated into Daguerre's discovery on the 22d of April, 1839, and was appointed Daguerre's agent in Germany. On the 22d of September, four weeks after the publication of the discovery, Sachse had already produced his first picture, at Berlin. In October, the earliest Daguerrean apparatus was sold in Berlin.

The first objects photographed by Sachse were architectural views, statuary and paintings, which, for two years, found a ready sale as curiosities. It was in 1840 that he first represented groups of living persons, and, in this way, photography became especially an art of portraiture.

Daguerre's first pictures needed an exposure of 20 minutes, too



long for taking portraits. He, therefore, stated that living objects could not be photographed—they could not keep still long enough.

The publication of the discovery produced the liveliest interest in scientific circles. Pamphlets describing the apparatus and the process were issued from the French press. The first to reach New York was brought from London by Mr. Seger of New York. As the packet ship on which he sailed was leaving her dock, one of Daguerre's pamphlets was thrown on the deck by a friend of Mr. Seger, who, immediately on his arrival in New York, took it to Prof. Morse, of Telegraph fame. Morse was quick to see that a new field of art-industry would be opened. He took it to his instrument-maker, George W. Prosch, and said, "Make the apparatus as soon as you can." In a few days it was done, and the first trial was a picture of the Old Brick Church (Dr. Spring's) and the City Hall, with a hack, horses, and driver who was sleeping on his box. Prosch's shop was in the basement of the old Morse Building, 142 Nassau street. The camera was placed on the steps leading to the basement. This was the first photograph taken in this country. It was in October, 1839, less than a month after Seger's arrival.

As Prosch did work for me, I was in his shop almost every day, and knew all that was going on. Prof. Morse, Dr. James R. Chilton, chemist, G. W. Prosch, Dr. John W. Draper and myself entered with great zeal into the practice of the new art. The first thing of importance was to get an accurate lens which could give the best result; and the next, chemicals more sensitive than iodine to the action of light. Draper, the accomplished chemist and afterward the renowned physicist, was successful in employing an acromatic lens, which he has described, and in mixing bromine with iodine or their salts, thereby reducing the time for the light to act upon the plate, and, as a consequence, obtained the first portrait of a living human face.

Draper, in his *Scientific Memoirs*, page 215, in a Historical Note on the taking of portraits from life by photography, published in the London *Philosophical Magazine*, September, 1840, says: "This Memoir contains the first published description of the process for taking daguerreotype portraits. That it was possible



by photogenic processes, such as the daguerreotype, to obtain likenesses from life was first announced by the author of this volume in a note to the editors of the *Philosophical Magazine*, dated March 31, 1840, as may be seen in that journal for June, 1840, page 535. The first portraits to which allusion is made in the following memoir were produced in 1839, almost immediately after Daguerre's discovery was known in America."

In the *Edinburgh Review* for January, 1843, there is an important article on Photography—in that, the invention of the art of taking photographic portraits is attributed to its true source—the author of this book. It says: "He was the first, we believe, who, under the brilliant summer sun of New York, took portraits by the daguerreotype. This branch of photography seems not to have been regarded as a possible application of Daguerre's invention, and no notice was taken of it in the reports made to the legislative bodies of France. We have been told that Daguerre had not at that period taken any portraits; and, when we consider the period of time—twenty or twenty-five minutes—which was then deemed necessary to get a daguerreotype landscape, we do not wonder at the observation of a French author, who describes the taking of portraits as "*Toujours un terrain un peu, fabuleux pour le Daguerreotype.*"

"Very soon after M. Daguerre's remarkable process for photogenic drawing was known in America, I made attempts to accomplish its application to the taking portraits from the life. M. Arago had already stated, in his address to the Chamber of Deputies, that M. Daguerre expected by a slight advance to meet with success, but as yet no account had reached us of that object being attained.

"In the first experiments I made for obtaining portraits from the life, the face of the sitter was dusted with a white powder under an idea that otherwise no impression could be obtained. A very few trials showed the error of this, for, even when the sun was only dimly shining, there was no difficulty in delineating the features."

Unless a prior date can be shown in favor of some other photographer, Draper's claim must stand.

Prosch opened a daguerrean gallery at the corner of Broadway and Liberty street. The light of the sun was thrown directly in the face of the sitter by means of a mirror, which was suspended out of the window. All the portraits, as a consequence, did not show the eyes, which gave the features a ghostly look. I was one of the first to sit to him. These early specimens, for I had many, I used to exhibit in my lectures on photography. But, unfortunately, after a few years' exposure, they faded out, for the process of gilding was not yet known which makes the picture permanent.

About this time, or soon after, many others went into the business, and among the most successful was A. S. Walcott, a mechanician, who opened daguerrean rooms in the granite building, No. 273 Broadway, corner of Chambers street. I immediately made his acquaintance and sat for my portraits. Several of these are still in my possession.

A fuller history of photography has been given than would have been necessary had not the priority of taking portraits been questioned. Some twenty years ago, an attempt was made in the American Institute of New York to take the honor from Draper and give it to A. S. Walcott. A committee was appointed to investigate the claim. Dr. Draper was called on, who furnished the committee with a written statement, which was substantially the same as that published in his *Memoirs*. The friends of Walcott refused to make a statement in writing, and, as a consequence, the matter was dropped. Morse, I think, had a better claim than Walcott, who photographed his daughter on the top of a house in Broadway in 1839, but he never set up the claim of priority to Draper's.

One of the most valuable instruments of modern research is the *Spectroscope*, which was invented by Kirchhoff, of Berlin, in 1859. It has interpreted the dark lines of the solar spectrum. It has solved the most delicate problems of chemical and microscopical investigation which seemed inscrutable before this method of research had been invented. It has penetrated the heavens and revealed the composition of the sun, stars and nebulae. It

has shown the presence of several terrestrial elements in the solar atmosphere, thereby proving that the Universe of worlds is composed of similar elementary matter.

One of the most striking operations of spectrum analysis is the application of it, devised by Dr. Huggins, to the determination of the rate of motion of the stars, to or from the solar system. Light of any color is due to quicker vibrations than light of a color nearer the red end of the spectrum. Dr. Huggins observed, that in the spectra of some of the stars, the dark lines were at exactly the distance apart that they would be if they were produced by known gases, but that they were all displaced out of their true positions on the spectrum. He therefore was led to believe that when the lines are displaced towards the blue end of the spectrum, the star is moving towards us ; when towards the red end, it is moving from us. Knowing the wave length of light of every color, and knowing the velocity of light, he was able to estimate by measuring the displacement, the rate of motion of the star.

Of all the heavenly bodies, that of whose constitution spectrum analysis has taught us so much, and that which is the most important to us, being the source of all the heat and light and life of our system, is the Sun. During a total eclipse, we can see much of him which is ordinarily obscured by his glare. He appears to consist of several concentric spheres of different sorts of matter. Outside all, is the zodiacal light which, on the nebular hypothesis, consists of uncondensed nebulous matter. Inside this, but surrounding the sun to a distance about equal to his diameter and with streamers issuing from it to a much greater distance, is a bright glare called the corona. Inside this again and close round the sun, is a rose-colored envelope called the chromatosphere, from which prominences issue occasionally to a height of more than a third of the sun's diameter, and inside all is the bright surface of the sun, which is ordinarily visible, and which is called the photosphere ; on this are dark spots which look like holes opening into unknown depths.

Spectrum analysis tells us that the zodiacal light is reflected sunlight ; that the corona shines mainly with reflected sunlight,

but that it also contains a self-luminous unknown gas; that the chromatosphere with its prominences consists almost entirely of incandescent hydrogen, though occasionally other gases appear in it; the photosphere gives the ordinary solar spectrum, and therefore must consist of incandescent solid or liquid, or gas at an intensely great pressure.

We learn, then: 1. That the temperature of the sun is so high that the metals are in a state of vapor. 2. That we know nothing of the central parts of the sun. 3. That the photosphere, or brilliant disc of the sun, is probably gaseous; is the seat of violent commotions, transcending all terrestrial cyclones; is covered with flame-like granules; that it contains two regions of spots, one lying to the north, the other to the south of the solar equator; that the spots revolve at different speeds, depending upon their latitude; that the speed in the northern zone are greater than those in corresponding latitudes in the south; that the spots are variable in duration; that they come and go in a cycle of about 11.07 years; this cycle influences terrestrial magnetism, temperature, rainfall and other phenomena; the cycle depends upon the planetary positions; the spots are comparatively cool regions, caused by a down-rush of vapor; the motion of the vapors is cyclonic; in the neighborhood of the spots bright faculæ occur; around the photosphere is a region of glowing vapors, chiefly hydrogen, called the chromatosphere, which is the seat of violent commotions; yet, plains and heaped prominences recording their existence, some of which is irruptive, others cyclonic.

In 1877, Professor Henry Draper of New York, in his spectroscopic experiments, discovered oxygen in the sun. He found that it gave *bright* lines on the solar spectrum in contrast to the *dark* lines given by the metallic bodies. For this reason, it had escaped notice, for it is more difficult to see bright lines on a *bright* spectrum than dark ones. This discovery of Draper proves the existence of certainly one of the metalloids in the sun. It also shows that the solar spectrum must be regarded as *continuous*, with both bright and dark lines, and that the bright lines are in all probability those of the metalloids. His brilliant discovery affords

strong grounds for the hope that metalloids may be detected almost as readily as metals.

Another fascinating study of which we knew nothing in our college course is the *polarization of light*. By the use of the polariscope, adulterations of many articles of commerce can be detected; the existence, in many tissues, of differences of density which would be inappreciable under ordinary illumination; beautiful appearances in all irregularly laminated cells. In a word, the *polariscope* is useful for displaying the minute structure of many substances, in some of which it cannot be detected in any other way, and frequently causing crystals to present a most gorgeous array of colors.

In 1858, Helmholtz published his interesting investigations in molecular mechanics. It is a mathematical discussion of what he calls ring-vortices in a perfect, frictional fluid, and that they possess an eternal perpetuity, although passing through endless transformations. The element of the new physics is not an atom or congeries of atoms, but a whirling vapor. All we know of matter is its presence and its motion. The modern science of Acoustics is also due to this great German philosopher.

In 1849, Fizeau, and, in 1862, Foucault, undertook the determination of the difficult problem of the velocity of light; according to the former 180,000, according to the latter 185,000 miles per second. The difference in their results is only about six per cent. The arithmetical mean of the two values comes very near to the astronomer's estimate of the velocity of light. By these experiments, which were conducted on entirely different methods, the science of optics is placed on an independent basis.

#### METEOROLOGY.

This science is of recent development. Lieut. Reid and Col. Fitzroy of England, and Redfield and Espy of this country, made a series of observations on the laws of storms which were published in Silliman's and other journals; but nothing practical was undertaken till a system of observations was established by the Regents of the University of New York, under the patronage of the



Legislature, in 1825. The colleges and academies of the State were selected as the proper agents to carry out the purpose of the Regents. A large accumulation of observations was made, but owing to the want of a proper method of conducting the observations, with uniform instruments, the labor was to a very large extent lost.

In 1849 and 1850, another appropriation was made to establish a new system of observations. The Regents at Albany employed Prof. Arnold Guyot, of Neuchatel, Switzerland, a student long devoted to science, a pupil of Carl Ritter, and author of a valuable work on Physical Geography, and since known as the learned professor at Princeton College, to take charge of the stations.

The following note was received from the Secretary of the Board of Regents:

“ALBANY, November 24, 1849.

“CHARLES E. WEST, ESQ.:

“*Dear Sir,*—

“I send this merely to say that Rutgers Female Institute has been selected as one of the meteorological stations. Prof. Guyot will visit you some time next month and make all necessary arrangements.

“Yours truly,

“T. ROMEYN BECK.”

In accordance with the Secretary's instructions, Prof. Guyot visited me and arranged the apparatus. Observations at definite hours and three times a day were made, while I remained in New York, and afterward at Buffalo.

In 1850, a general system of meteorological observations was established at Washington under the direction of Joseph Henry of the Smithsonian Institution. A Weather Bureau was established by the United States Government, and General Albert Meyer, an army officer, was appointed Superintendent. Under his arrangement, the system was perfected, the advantages of which to commerce and the general industries of the country are of incalculable importance.

One of the most extraordinary feats of intellectual power during the half century was the calculating engine of Charles Babbage. It

furnishes demonstrative evidence that the whole of the developments and operations of analysis are now capable of being executed by machinery. There are various methods by which these developments are arrived at: 1. By the aid of the Differential and Integral Calculus. 2. By the Combinatorial Analysis of Hindenburg. 3. By the Calculus of Derivatives of Arbegast.

A new science is "Kinematics," or what Prof. Willis called the "Science of pure Mechanism," and Rankine the "Geometry of machinery," and "Recoleaux Kinematics."

Every department of Natural History has been enlarged and enriched. Mineralogy, geology, paleontology, botany, zoology, entomology, etc., are newly created sciences. Our countrymen who have labored in these departments come in for their share of the honors. By legislative enactment, large sums of money have been expended for geological surveys. North Carolina took the lead in 1824 and 1825, under Prof. Olmsted; South Carolina under Prof. Vanuxum; Massachusetts, under Hitchcock, in 1830; Maine, in 1836, under C. F. Jackson. New York, Connecticut and other States have followed, and a large mass of valuable information has been gained for the benefit of the miner, the farmer and the political economist.

In biology, in animal and vegetable physiology, the microscope has opened up new sources of information. In the study of cell-development, the labors of Fallopius in 1562, Borellus in 1656, Haller in 1757, Wolf in 1759, and, many years later, Schleiden and Schwann, have been continued by Huxley, Bastian, Haeckel, Wallace, Verchow and others. Huxley, "On the Physical Basis of Life," observes that the existence of the matter of life depends on the pre-existence of certain compounds, namely, carbonic acid, water and ammonia. Withdraw any one of these three from the world, and all vital phenomena are at an end. They are related to the protoplasm of the plant as the protoplasm of the plant is to that of the animal. Carbon, hydrogen, oxygen and nitrogen are lifeless bodies. Of these, carbon and oxygen unite in certain

proportions and under certain conditions, to give rise to carbonic acid ; hydrogen and oxygen produce water ; nitrogen and hydrogen give rise to ammonia. These new compounds, like the elementary bodies of which they are composed, are lifeless. But when they are brought together, under certain conditions, they give rise to a still more complex body—protoplasm—and this protoplasm exhibits the phenomena of life. Subsequently, cells are developed, but they are mere cavities and not independent entities ; organization is not affected by them ; they are the visible results of the action of the organizing power inherent in the living mass, or what Wolf calls the *vis essentialis*, and Bastian “ Spontaneous generation.” Then comes the free cell development of Schleiden, which he divides into two distinct methods of cell growth, one of which, the so-called “ exogenous free-cell formation,” must be regarded as a true creative art, while the other, “ endogenous cell formation,” is a mere continuance of the process, or cell formation. In the midst of a perfectly structureless, clear, transparent fluid, which he calls blastema, cyto-blastema, granules are first seen, some of which increase in size and assume the form of a minute visicle, the nucleus of the future cell. On the addition of water to this, granules become apparent in its interior, and one of these, larger than the rest, appears to be the nucleolus. Around the nucleolus, the cell membrane is developed and the cell is completed.

In 1858, the doctrine of spontaneous evolution was revived by Pouchet of France. Pasteur of the French Academy repeated Pouchet’s experiments and found them of no value. Bastian of London declared that he was justified in “ believing that living things may and do arise, *de novo*.” In his “ Beginnings of Life,” he declares that monads, bactriæ, torulæ, vibrios, liptothrix, filaments, fungus, spores, etc., are developed from solutions of organic and saline substances absolutely destitute of living germs ; hence they must originate *de novo*.

Here we have among these naturalists, what may be called the battle of the Cell ! The question comes, What is Life ? Ah ! That is the question of questions ! No chemical analysis is subtle enough to determine that ! No penetrating power of the sunbeam, however skillfully used, can pierce that inscrutable secret of the

Almighty! He who made the elementary matter which combines in certain well-known proportions has *shown* his creative power, but chosen to *conceal* that impalpable, subtle something, which vitalizes the vegetable and animal organism which we call *life*! The secret of his working lies outside of the domain of philosophical investigation.

There is an unwillingness on the part of many scientific men to admit a Power acting on matter "from without," a God who "orders the Universe from a position outside it all." Tyndall, while treating of and explaining the methods of Nature, entirely drops out of thought the Power which works along these methods. "The very story of saline crystals and ice-stars, and fern fronds and human birth," he asks, "What else is there here than matter?" Much! The *movements* of matter, with their disposing and formative power, the attracting and repelling energies, which, *dealing* with molecules and cells, *are not* molecules and cells. Science deals only with sequences and succession of phenomena—not with *causality*. Science cannot tell us what it is that does the work—what it is that produces these movements of matter.

Evolution cannot account for the origin of things, nor can it explain the general laws of Nature. There never was and never can be any evidence that inanimate matter can produce mind, or that mechanical action can produce mental activity. There is not even the semblance of the presence in the original atoms scientists talk about, of the life, mind, feeling, consciousness, power of judgment, discernment and reasoning that subsequently make themselves manifest.

Scientists generally agree that "force can neither be created nor destroyed," and that "the quantity of force in nature is just as eternal and unalterable as the quantity of matter."

Dr. Barnard, in his address before the Scientific Association in 1869, says: "Organic changes are physical effects, and may be received without hesitation as the representative equivalents of physical forces expended. But sensation, will, emotion, passion, thought, are in no conceivable sense physical.

"The philosophy which makes thought a form of force, makes thought a mode of motion, converts the thinking being into a

mechanical automaton, whose sensations, emotions and intellections are mere vibrations produced in its material substance by the play of physical forces, and whose conscious existence must forever cease when the exhausted organism shall, at length, fail to respond to these external impulses.

"Thought can not be a physical force, because it admits of no measure. A thing unsusceptible of measure cannot be a quantity, and a thing that is not even a quantity cannot be a force."

In this connection, allow me to introduce a few passages from the famous "Discourse on Molecules," delivered before the British Association at Bradford, in September, 1873, by James Clark Maxwell: "In the heavens we discover by their light, and by their light alone, stars so distant from each other that no material thing can ever have passed from one to another; and yet this light, which is to us the sole evidence of the existence of these distant worlds, tells us also that each of them is built up of molecules of the same kind as those which we find on earth. A molecule of hydrogen, for example, whether in Sirius or Arcturus, executes its vibrations in precisely the same time.

"Each molecule, therefore, throughout the universe has impressed upon it the stamp of a metric system as distinctly as does the metre of the Archives at Paris, or the double royal cubit of the temple of Karnac.

"No theory of evolution can be formed to account for the similarity of molecules, for evolution necessarily implies continuous change, and the molecule is incapable of growth, or decay, of generation or destruction."

None of the processes of Nature since the time when Nature began have produced the slightest difference in the properties of any molecule. We are therefore unable to ascribe either the existence of the molecules or the identity of their properties to any of the causes which we call natural.

On the other hand, the exact equality of a molecule to all others of the same kind gives it, as Sir John Herschel has well said, the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent.

Thus we have been led along a strictly scientific path, very



near to the point at which science must stop. Not that science is debarred from studying the internal mechanism of a molecule which she cannot take to pieces, any more than from investigating an organism which she cannot put together. But in tracing back the history of matter, science is arrested when she assures herself, on the one hand, that the molecule has been made, and, on the other, that it has not been made by any of the processes we call natural.

Science is incompetent to reason upon the creation of matter itself out of nothing. We have reached the utmost limits of our thinking faculties when we have admitted that, because matter cannot be eternal and self-existent, it must have been created.

It is only when we contemplate, not matter in itself, but the form in which it actually exists, that our mind finds something on which it can lay hold.

That matter, as such, should have certain fundamental properties—that it should exist in space and be capable of motion—that its motion should be persistent, and so on—are truths which may be, for anything we know, of the kind which metaphysicians call necessary. We may use our knowledge of such truths for purposes of deduction, but we have no data for speculating as to their origin.

But that there should be exactly so much matter and no more in every molecule of hydrogen is a fact of a very different order. We have here a particular distribution of matter—a collocation—to use the expression of Dr. Chalmers, of things which we have a difficulty in imagining to have been arranged otherwise.

The form and dimensions of the orbits of the planets, for instance, are not determined by any law of nature, but depend upon a particular collocation of matter. The same is the case with respect to the size of the earth from which the standard of what is called the metric system has been derived. But these astronomical and terrestrial magnitudes are far inferior in scientific importance to that most fundamental of all standards which forms the base of the molecular system. Natural causes, as we know, are at work, which tend to modify, if they do not at length destroy, all the arrangements and dimensions of the earth and the whole solar

system. But though in the course of ages catastrophes have occurred, and may yet occur, in the heavens, though ancient systems may be dissolved and new systems evolved out of their ruins, the molecules out of which these systems are built—the foundation-stones of the material universe—remain unbroken and unworn. They continue this day as they were created—perfect in number and measure and weight; and from the ineffaceable characters impressed on them, we may learn that those aspirations after accuracy in measurement and justice in action, which we reckon among our noblest attributes as men, are ours because they are essential constituents of the image of Him who in the beginning created not only the heaven and the earth, but the materials of which heaven and earth consist. A scientific conception of the universe must embrace the three mysteries—Matter, Life and God.

We need not trouble ourselves with anxieties about questions which Science may suggest; we feel sure, as Graham remarks, "that there is in the Universe an existence over and above all phenomena, whether viewed as unconditional existence with Kant; as infinite substance with Spinoza; as inscrutable Power with Spencer; a transcendent Something, of which matter and mind are alike merely phenomenal manifestations or modes which are far from being exhaustive of its whole nature. There is an Ultimate Reality, vaster and deeper than all we know or dream of matter, grander than all we can think of or imagine, in mind. There is a mighty living and universal Power which lives and moves in the universal being and essence of all persons—a Power, resistless but beneficent, of which matter and energy, life and light, thought and volition, are but forms; a Power, too, whose exhaustless life and energy are but slightly drawn upon by all the various demands made upon it in our little earth, working, as it does, simultaneously as one and the same power in each of the myriad stellar systems disposed through infinite space. In the most distant orbs, from which Science, by her searching analysis and improved methods of observation, has recently brought back her spectroscopic, supplementing here telescopic, reports; the same Power is displayed in the composition of matter and in the maintainance of law as at home on the earth; and probably in many of those distant

spheres it works in the production of life, while probably also, nay somewhere certainly; and whether working by other and superior art, or working, as here, by natural selection chiefly, it has attained to grander and more excellent results than the choicest terrestrial things—to a truth more clear and free from error, to a beauty more pervading, to a happiness less fugitive and more unalloyed, to a virtue superior to our poor earthly product.”

This Ultimate Power “is no more representable in terms of human consciousness than human consciousness is representable in terms of a plant’s formation.” While man remains subject to the limitations of consciousness, he cannot compass in thought an existence transcending all consciousness, and man must be forever subject to these limitations.

This Ultimate Reality in the universe is God.

There is a Power behind phenomena, which produces them; a substance one and the same at the bottom of the universe and of our thought, which preserves them both in law and order; a Power whose existence is our only final guarantee that the physical universe will not resolve itself into chaos before our eyes, and that the universal reason will keep steady on her throne. This Power removed—if we could or dare suppose it—anarchy in the atoms, universal chaos within and without, in the brain and in the cosmos, is conceivable; this Power present and eternally supporting all is our guarantee to the contrary. And, once more, this final support and Power, is God.

In looking over Newton’s *Principia*, I came across this memorable utterance, which shows that his intuitive powers brought within the range of his vision the philosophies of our time.

“The world is not God, as the Pantheists affirm. It did not exist from eternity, as the Peripatetics taught. It was not made by Fate and Necessity, as the Stoics said. It did not arise from a fortuitous concurrence of atoms, as the Epicureans asserted, nor from the antagonism of two rival powers, as the Persians and Manicheans affirmed; nor was it made by angels, or by incarnations of æons, as some of the ancient Gnostics held; nor out of matter co-eternal with God, as Hermogenes said; nor by spontaneous

energy and evolution of self-developing powers, as some have affirmed in later days; but it was created by One, Almighty, Eternal, Wise and Good Being—God.”

That which caused the integration of the earth and the production of light and heat, was energy. Energy may be defined as the power of doing work. There is always a tendency, in every transformation of energy, to pass from a higher to a lower form; indeed, all the energy in the universe is passing on to the lowest and final form of equally diffused heat. This, the dissipation of energy, is by no means well understood. There can be little question that the principle concerns the whole theory of thermoelectricity, of chemical combination, of allotropy, of phosphorescence, etc., and perhaps, matters of a higher order than common physics and chemistry. In astronomy, it shows us the material of potential suns in the process of formation, in vigorous youth, in the phase of habitation for life, and in every other stage of lingering decay. It reveals to us every planet and satellite as formerly a tiny sun. It carries forward our thought to a time when the materials of present systems shall be component parts of future larger suns and planets. Finally, it conducts us to that necessary future, if physical laws remain unchanged when the present glittering show of life will be dark and cold and dead. It also reminds us of a beginning, a state beyond which we are totally unable to penetrate, a state produced by other than now visibly acting causes, by that transfer of energy from the Unknown of which the universe and all material phenomena are memorials.

The elementary atoms, possessing their own shapes and powers, arrange themselves into molecules of manifold combination and exceeding variety of vibrations. When raised to incandescence, or white heat, and their lights are tested by spectrum analysis, the glowing vapors indicate by luminous lines the different elements which are in combustion; thus we are learning of what materials the sun and stars are composed.

Heat and light are the product of a transfer of energy. Transfer of energy, through a solid body, is effected simply by vibration of the solid body; through air, by setting it in motion at own period of vibration; through what we call a vacuum, by

the magnetic medium—that which Clark Maxwell gives reason to believe is the medium which conveys light and radiant heat. Vibrations occurring less frequently than sixteen times in a second, produce in us consciousness of a succession of noises. Vibrations occurring oftener than 16, but less than 30,000 times in a second, produce in us the consciousness of musical notes, varying in pitch with the vibrations. Vibrations occurring oftener than 30,000, but less than 458,000,000,000,000 times in a second, do not affect us through the ears; but the more rapid ones, acting through the nerves of the skin, produce in us the consciousness of heat. Vibrations at the rate of 458,000,000,000,000 in a second affect us through the eyes, and produce our consciousness of red light. As the vibrations increase, corresponding shades of color appear, until, at the rate of 720,000,000,000,000 in a second, we have the consciousness of violet light. Higher rates produce no definite state of consciousness in us. Thus, by one and the same external agency—vibrations among particles of matter—are sensations caused, as sound, heat, light.

In sound waves, the particles of air vibrate back and forward in the direction travelled by the sound. If by another sound we raise such undulations as fill the depressions in the waves of the former sound, this adding of sound to sound will cause silence. Light and heat travel at a rate of about 186,000 miles a second; the direction of the vibration is across the direction in which they move. Two sets of rays may be made so to interfere with one another as to be mutually destructive. The two rays of light produce darkness, and the two rays of heat cause heat to disappear. Passing a beam of solar or electric light through a prism, we obtain the beautiful colors of the spectrum. At one end is the red, at the other the violet, the remaining prismatic colors lying between. Red is the hottest of the colors, and beyond it are the invisible rays called the heat rays. Violet is the coldest, and beyond it are the actinic or chemical rays, also invisible. In the three—heat, light, actinism—reside the miraculous generative energy, which fills the earth with warmth, life and splendor. Concerning their nature, whether we call it vibration, or heat, or light, or actinism, we affirm nothing and know nothing.



To a certain extent we can give a mechanical explanation of heat and light, as the products presented to our consciousness of a perpetual tumbling, or swaying to and fro of the invisible atoms of which visible bodies are composed; but when the explanation is connected with the linked purpose of the whole, we are conscious of wisdom and might exceeding all our thought. Light, wonderful and mysterious, is but a single point in the vast scheme of nature. It is passed through ether by means of transversal disturbances or vibrations. Several optical phenomena indicate that a disturbance partaking, if such be possible, of the nature of compression, would be transmitted with a velocity almost infinitely great in comparison with the existing velocity.

The medium actually used, ether, is specially fitted for the transmission of the small waves which constitute light. The waves are so small, that from forty to fifty thousand are required to occupy the breadth of an inch, and trillions enter the eye during a few seconds. The red wave has a length of the  $\frac{271}{10,000,000}$ th part of an inch. In one second 458,000,000 of vibrations occur. At the line H, in the violet, the length of the wave is  $\frac{155}{10,000,000}$ th part of an inch, and the number of vibrations is 727,000,000 the second. The optic nerve is not conscious of the heat in the hot rays, nor of waves larger than the red, nor of those smaller than the violet. The eye is only able to see different proportions of the three primaries—red, green, violet; therefore our sight may be fairly considered as rudimentary. Every one of these is capable of innumerable different degrees of sensation; one, two or three primary colors. What a manifold undeveloped system of signs and images we have within us.

Again, I would allude to the microscope, and in connection with it, to the scientific labors of Ehrenberg and Bailey of West Point.

A few words in respect to the microscope. Its history would require a treatise. It is one of the most important instruments in modern research. I have seen its development from the ordinary magnifying glasses of the shops, to the magnificent lenses of Tolles, Spencer, Wales, Miller, Powell and Lealand, Ross, Beck, Hartnach, Zeiss, Gunlach, and other makers of first-class object-

ives. I have in my collection the finest English, French, German and American achromatic lenses, varying in focal distance from five inches to the fiftieth of an inch. My best lenses are American. Among these are Tolles' tenth, twenty-fifth and fiftieth; Wales' thirtieth; Miller's eighteenth and fortieth, and Spencer's fourth. The latter is the most remarkable lens in my collection of fifty objectives. It was made by the younger Spencer. It will resolve the *Amphipleura Pelucida*, Nobert's nineteenth band, which are among the most difficult tests of the resolving power of objectives. I have not time to speak of microscopical stands and their accessories which have been carried to great perfection. The microscope, for its perfectability of workmanship and for its marvelous revelations, rivals the telescope, great as has been the improvement of the latter during the past fifty years.

Although the science of microscopy is of comparatively recent origin, it has taken equal rank in value and importance with its sister science, telescropy. In practical, every-day life, the microscope is of far greater value to society than the telescope. Its range, it is true, is limited to the objects of earth. It acquaints us with the structure and functions of organism, which are altogether too minute to be seen by ordinary and unassisted vision. It enables us to revel in a world of beauty. The stranger to the microscope can form no conception of the delicate forms and picturesque groupings which everywhere abound in the microscopic world. God's marvelous and exquisite handiwork is more fully revealed in these tiny microcosms, than in the grosser forms with which in ordinary life we are familiar.

Every child should be taught the use of the microscope. A few shillings will put him in possession of an instrument that will introduce him into a new world, and make his life richer and happier.

Its practical use in the arts is not to be estimated. In the investigations of the physiologist and anatomist, it is indispensable, for to what else but to this instrument, does histology owe its origin and development? Some glimpses of organic structure had been obtained by the earlier observers, Leenwenhoek, Malpighi, Hooke and others; but these, for the most part, consisted of

unconnected observations, from which it was impossible to educe any of the general laws of formation and development. But now, through the researches of such earnest and devoted histologists as Bichat, Schwann, Reichert, Vogt, Kolliker, Schleiden, Quekett and Carpenter, we are made acquainted with the minute tissues of animal and vegetable bodies. The tissues have not only been examined in their healthy but also in their abnormal diseased condition, so that we have not only a microscopic physiology, but a microscopic pathology.

But there is not time to speak further of the uses of the microscope. Of its construction and of those who have distinguished themselves in developing this almost perfect instrument, we would like to devote an entire paper. A few words in regard to the most important part of the microscope—the objectives. In the construction of these, lies the maker's skill and the value of his reputation. For the last thirty years, the improvement in lenses has been marked and progressive. Such is the perfection of the immersion lense of to-day, that it seems impossible to add anything more to its value. All the mechanical difficulties have been overcome. The excellence of a lense depends upon its freedom from chromatic and spherical aberration, and upon the magnitude of its angular aperture, definition resulting from the former and penetration from the latter. The advantages claimed for immersion lenses are: greater working distance between the object and objective, increase of light and superior definition and clearness in the optical image, which image is obtained by much simpler illuminating apparatus, and with less manipulative skill than that considered indispensable in using high-power dry objectives.

"It is not difficult to see," says Mayall, "that Amici's system of connecting the objective with the cover glass by a film of water, very much diminishes the reflection which necessarily takes place on the incidence of oblique light when the dry objective is used. The limiting angle of refraction in water being about 48 degrees, it follows that, whatever is the degree of obliquity in the incident light on the object, the immersion objective never has to do with rays of greater obliquity than 48 degrees. To this, in great measure, is due the greater clearness and precision of the image obtained."

Great perfection has been reached in the preparation of microscopic objects. The Danes and Germans lead in this department. The mounting of diatoms by I. D. Möller, of Wedel, is beyond all competition. This Diatomaceen Typen-Platte, as he terms it, has under cover four hundred diatoms, without counting the *Eupodiscus Argus*, sixteen in number, which he has placed at the corners of the four squares in which he has grouped his specimens. These he has catalogued and arranged under seventeen orders, according to the classification of A. Gurnow, of Vienna, the *Epithemieæ*, *Meridioneæ*, *Diatomæ*, *Tabellaricæ*, *Surirellæ*, *Nitzschicæ*, *Amphipleureæ*, *Cocconeidæ*, *Achnantheæ*, *Cymbelleæ*, *Gomphonemæ*, *Navieulaceæ*, *Isthmæ*, *Biddulphiæ*, *Eupodisceæ*, *Melosircæ* and *Chaetocereæ*—ninety-nine genera and three hundred and eighteen species—a complete cabinet of diatoms, and all on one slide.

Of injected animal tissues, those of Prof. Tiersch, of the University of Leipsic, are of unequalled perfection and beauty. There are in my cabinet more than four hundred of them. Edward Bicknell, of Cambridge, and I. Bourgoque, of Paris, have done admirable work in this line.

But I wish to speak of Ehrenberg and his microscopic labor. Researches in this extremely difficult branch of science began one hundred and fifty years before Ehrenberg entered upon his successful career. He was born in Delbisch, Saxonia, April, 1795. He entered the University of Leipsic in 1815, and received his medical diploma in 1819. His thesis was "A New System of Moulds," which, on publication, created a sensation in the scientific world. He described in this pamphlet 240 different forms of microscopical plants, which, before his researches became public, were taken as Infusoria. It attracted the attention of the Prussian Academy of Science, and in consequence, he was recommended for similar investigations which were intended to be made in Egypt. The Prussian government sent him, at its expense, to that country, and extended its period after two years of his stay there, to six years. The result of his labors were published on his return in his "*Symbolæ Physicæ*;" "*On the Corals of the Red Sea*," and its *Akoliphia*.

Although these coral banks were known to Pliny and Strabo, nothing definite could be said of them; they were believed to be plants which putrify on reaching the surface of the water.

Ehrenberg classified and described one hundred and fifty species of these animalculæ, of which the lives of centuries are required to increase in a small degree the height of these banks.

On his return from Egypt, he received from the Prussian government the Professorship of the University of Berlin, and a few years later, he was invited to accompany Humboldt and Rose to Asia to make investigations in natural history, which he accepted.

They returned in 1839. In 1853 his great works, "The Infusoria as Perfect Organism," and "Microgeology," were published, which were illustrated by excellent drawings made by himself. These works are now rare and exceedingly costly.

Microscopical life was the great and wonderful subject which he undertook to investigate. For this purpose he travelled in Europe, Asia and Africa, corresponded with scientific men, and was supplied with infusorial specimens from all parts of the world—from the arctic regions as well as from the tropics; from the highest mountains to a depth of 12,000 feet below the surface; from the source of rivers as well as from the coasts of lakes. These microscopic beings, living and fossil, he examined and showed their forms to be infinite.

Not only existing forms of infusoria were found by him, but those also of thousands of years ago. He made forty microscopic analyses of each specimen sent him, from which it may be inferred that his observations were reliable and highly esteemed. He gained the admiration of the scientific world, and was made an honorary member of their learned societies. Cuvier said that Ehrenberg's labors would make him immortal. Like most of great men, he was amiable, humble and unpretending.

A contemporary of Ehrenberg in microscopical analysis of Infusoria, was Prof. J. W. Bailey, of West Point, who was born April 29, 1811, in Auburn, Massachusetts. He graduated from the Military Academy, July, 1832. In 1839 he was appointed Professor of Chemistry, Mineralogy and Geology, in the same



Academy, and remained there till his death, in February, 1857. His taste for science was very largely developed. Beginning with botany and mineralogy, and passing from those to geology, chemistry and microscopy, he traversed a large portion of the field of natural science. By his great skill with the pencil, he made valuable drawings of vegetable and animal tissues, and later, of diatoms, algæ, etc. His microscopic and collecting bottles were his constant travelling companions.

His published papers are numerous—more than fifty. They are mostly to be found in Silliman's Journal of Science, and in the Smithsonian Contributions to Knowledge, except one in the first volume of the Transactions of the Association of Geologists and Naturalists, which embodied his previous papers on the Infusoria of the United States.

In March, 1839, he sketched a new diatom, to which Ehrenberg gave the complimentary name *Stauronema Baileyi*.

His microscopical collection is an honor to American science. The slides, five hundred and fifty in number, are arranged in boxes in the form of octavos, consisting of twenty-four volumes. There are more than three thousand objects fixed upon those slides, much of which are described by him. The collection of algæ is equally complete. It consists of thirty-two portfolios, containing about 4,500 specimens—a remarkable collection; few, if any, surpass it. Prof. Bailey bequeathed these collections, his books on Botany and Microscopy; his Memoranda, and his Scientific Correspondence, to the Boston Society of Natural History.

Bailey may well be styled the Ehrenberg of America, who has made for himself a place by the side of the most eminent microscopists and algologists of the Old World.

The work of Ehrenberg and Bailey has been taken up by others, and a general accumulation of interesting material has been made. The study of Diatomacæ has been pursued with most fruitful results.

Prof. H. L. Smith, of Geneva, N. Y., has prepared an alphabetical series of diatoms on glass slides, which he terms "Species Typicæ Diatomacearum," which has been extended to several hundred—a valuable contribution.

Dr. Henri Van Heurck published in 1880, "Synopsis des Diatomées de Belgique," in two Fascicules, or parts.

P. T. Cleve and A. Grunow have published from the Stockholm press a work entitled, "Beitrag zur Kessentreiss der Aretischen Diatomeen," and accompanying it, are five volumes of slides, numbering in all 276. These were examined by M. Grunow, of Vienna, who is a leading authority in this department of microscopy. These diatoms were selected with great care, and come from all parts of the earth.

Mr. F. Habershaw, of New York, is publishing an exhaustive catalogue of this family of Confervoid Algæ.

Beside the use of dictoms for testing the resolving power of lenses, Mr. F. A. Nobert of Barth, Pomerania, the late well-known optical physicist, whose rulings of fine lines on glass have, for many years past, been regarded as marvels of dexterity by the scientific world, furnished test-plates for the microscope, particularly the plate known as the 19-band plate, on which successive bands of lines are ruled of increasing fineness of division from the rate of 1,000 to the Paris line to 10,000, equal approximately to 112,000 to the English inch. The frustule of *Amphipleura Pelucida* has 92,700 to 92,900 stria to the inch. It was Nobert's opinion that the last four bands of his plate could not be resolved. In this he was mistaken, for Dr. Woodward of Washington not only resolved the 19th band, but he also photographed it. It was this photograph that convinced Nobert of his error in fixing a limit to microscopic vision at the 16th band.

He then ruled a new plate of twenty bands of lines, varying from 1,000 to 2,000 to the Paris line. The lines on the tenth band in this latter plate correspond in processes of division to the 19th band of the former plate. The makers of objectives have something to stimulate them in the future in making lenses that can resolve, if possible, the more difficult lines of his new plate. He died last year, without revealing the secret of his process of making and adjusting the ruling points. It is, therefore, conclusive that the limit to microscopic vision depends upon the *excellence* of the objective! It is a variable factor!

Rutherford of New York, Rogers of Boston, and Fasoldt of

Albany, have done fine line ruling on glass and metal, but I have no time to speak of them as I would like.

John James Audubon has made most valuable contributions to the study of Natural History. His great works are the "Birds of North America," in four volumes, and the "Quadrupeds of North America," in three volumes. Cuvier pronounced the former to be "the most splendid monuments which art has created in honor of Ornithology." Christopher North said of him, "He is the greatest artist in his walk that ever lived." As an *ornithologist* and *ornithological painter*, he never had his equal. It was my fortune, forty years ago, to meet him at the seances of the Lyceum of Natural History of New York. He was the most remarkable man of my acquaintance. He had the keenest and most penetrating eyes I have ever seen.

It is a pleasure to refer to the scientific labors of Louis Agassiz. He came to the United States in 1846, at the commencement of the great scientific awakening in this country. His European reputation had preceded him, and his arrival was hailed with joy. He was looked upon as the greatest authority in Paleontology. His "Fossil Fishes" furnished a model of study in the investigation of the remains of extinct fauna. He was learned in Geology, Zoölogy and Embryology. He was a fascinating lecturer on these subjects. He studied the coral reefs of Florida, the fauna and natural history of Brazil, S. A. He founded the Museum of Natural History in Harvard College, and left as a monument of his industry the "Fossil Fishes," published in 1834-44, in five vols., 4to, with an atlas of nearly 400 folio plates, in which 1,000 species were wholly and 700 more partially, figured and described. He was the founder of Fossil Ichthyology. In 1839, he published his "Natural History of the Freshwater Fish of Europe;" also "Descriptions of Echinoderms;" 1847, "Système Glacière;" "Nomenclator Zoölogicus," 1 vol., 4to; "Bibliographiæ Zoölogiæ," 3 vols., 8vo; "Twelve Lectures on Comparative Embryology," 8vo; "Methods of Study in Natural History;" "Geological Sketches;" "Life from the Egg—Twelve Lectures;"

Contributions to the "Natural History of the United States," 4 vols., 4to, etc.

In 1861, he received the Copley Medal for his original researches, from the Royal Society of London. He subsequently received the Monthyon prize and the Cuvier prize from the French Academy; the Wollaston prize from the Geological Society of London, and the Medal of Merit from the King of Prussia. He was elected into all the Scientific Societies of Europe and America.

He wrote with great facility in Latin, German, French and English. He was an uncompromising defender of the Classification of the Animal Kingdom by Cuvier, and had no patience with the doctrine of Evolution. In writing an introduction to "Nott and Gliddon's Types of Mankind," he was denounced as an infidel by the clergy; but he outlived all those censures, and was regarded by the clergy as the defender of the true philosophy. He once spent a week with me in Buffalo, and complained bitterly of his treatment, declaring that he was not an infidel, that his father was an orthodox minister, and that he was brought up to believe and did believe in the Christian system of religion.

I wish to record a little incident which occurred at that time. Ex-President Fillmore was dining with us one day, when he said to Prof. Agassiz, "I wish that you would explain to me what I regard as one of the marvelous things of science. I have read that by means of a single fossil fish-scale, you actually made a drawing of the fish to which it belonged, giving its size and form, and that the drawing and scale were deposited in the British Museum; and that years after, the fossil skeleton of that species of fish was found and sent to the British Museum, and that the drawing could not have been a more exact portrait of the object than the one you made. Please tell me how you did it." "There is nothing easier," said the Professor. "It was like putting into the hands of a skilled engineer or architect, a single stone of an arch, and asking him to make a drawing of the arch to which it belonged. The angle which the faces of the stone made with each other would determine the form and character of the arch."

Prof. Agassiz was a gentleman of pleasing manners, of great

personal beauty, and of brilliant conversational powers. He was the centre and charm of the social circle. At the meetings of the Scientific Association, he is still remembered not more for his great learning in the discussion of scientific subjects, than for his urbane manners and brilliant conversation at the evening social entertainments.

Prof. Agassiz was born May 28, 1807, in the Parish of Motier, Switzerland, and died in Cambridge, Mass., December 14, 1873, universally lamented and honored.

The establishment of the United States Coast Survey under Hassler and Bache and Peirce, has been of the greatest utility. Stations for tidal observation were established all along the Atlantic Gulf and Pacific coasts. Self-registering tide-gauges have been brought into extensive use. The character of the ocean currents along our coasts have been determined and their causes elicited. The exploration of the Gulf-stream commenced in 1844, was vigorously prosecuted, its temperature at the several depths determined, and its structure and laws for the first time detected. The cold wall of water between the Gulf-stream and the shore, as also the division of the stream proper into alternate bands of warm and cold water, were discovered and mapped out for the benefit of navigators and the use of scientists.

Capt. M. F. Maury's "Physical Geography of the Sea" was a valuable contribution to the navigation of the Atlantic Ocean.

The first reasonable explanation of earthquakes was given by Dr. Thomas Young, by suggesting the probability that earthquake motions are vibratory, analogous to those of sound. It was rather a suggestion than an explanation, for he gave no demonstration. This was in 1807. In 1846, Robert Mallet communicated to the Royal Irish Academy a paper "On the Dynamics of Earthquakes," in which is found this passage: "The transit of a wave or waves of elastic compression in any direction, from vertically upwards to horizontally, in any azimuth, through the crust and surface of the earth, from any centre of impulse or from more than one, and which may be attended with sound and tidal waves dependent



upon the impulse and upon circumstances of position as to sea and land."

Thus was fixed upon an immutable basis the true theory of earthquakes. It was incidentally shown in that paper that from the observed elements of the movement of the elastic wave of shock at certain points—by suitable instruments—the position and depth of the focus, or centre of impulse, might be inferred.

In December, 1857, occurred the great Neapolitan earthquake, which desolated a large portion of that kingdom; and an opportunity then arose for practically applying to the problems of finding the directions of earthquake shock at a given point through which it has passed, and ultimately the position and depth of focus. Mallet devised apparatus for measuring those movements. Seismology has become a branch of exact science. An Observatory has been established on Mt. Vesuvius by the Italian Government, and self-registering instruments are used under the direction of Prof. Luigi Palmieri.

This seismograph is a self-recording instrument, composed of two distinct portions—one for record of horizontal, or rather of what are called undulatory shocks; the other for vertical shocks. The instrument is of that class in which the wave movements are indicated by the displacement, relative or absolute, of columns of mercury in glass tubes.

The chemist has made great achievements. He has made a new nomenclature for his science. He has liquified and solidified carbonic acid; and what is more wonderful still, he has liquified oxygen, hydrogen and nitrogen! Out of coal tar, he has obtained a most remarkable series of analine colors (1860). He has discovered a method of preparing a new explosive agent, nitro-glycerine. By spectrum analysis, he has discovered new elementary bodies. He has studied the molecular condition of the three states of matter, the gaseous, the liquid and the solid. He has discovered a method of storing electrical energy for mechanical purposes.

One of the most laborious and successful students of nature was the late Prof. John W. Draper, whose scientific career has

been passed in our midst. A profound thinker, an elegant writer, a poet as well as a philosopher, he did much to advance the civilization of the nineteenth century. His great scientific work was the "Chemistry of Plants," published in 1844, an important treatise on the forces which produce the organization of plants. He also published a paper upon the experimental examination of the distribution of heat and of the chemical force in the spectrum; also a treatise on "Human Physiology;" also "History of the Intellectual Development of Europe" (1872), in which he undertook to show that "social advancement is as completely under the control of natural law as is bodily growth," and that "the life of an individual is a miniature of the life of a nation." "Thoughts on the Future Civil Policy of America." In this work, he emphasized the influence of physical conditions, studied the effects of the groupings of so many nationalities, and concluded that America would become the theatre of a vast conflict of ideas, and that her safety required the abolition of the "European method of government through the morals and the adoption of an American method of government through the intellect." His ruling ideas reappeared in his "History of the American Civil War" (1867-70); "History of the Conflict between Religion and Science" (1878). In 1878 appeared his "Scientific Memoirs; or, Experiments Contributing to the History of Radiant Energy."

His researches in spectrum analysis and in the endosmosis and exosmosis of liquids were especially interesting. He was on the verge of making the great discovery which has since conferred scientific immortality on the German scientist, Kirchhoff, the interpretation of the dark lines in the solar spectrum. Draper took the first image of the human face by the photographic art. In 1840, he made the discovery of the curious phenomena of voice figures, also known as Moser's images, which are formed when a coin is placed upon a polished surface of glass, marble or metal, and remain latent until brought out by the condensation of vapor by breathing on it. This he showed me in 1843.

Dr. John Torrey was one of the ablest pioneers of American science. April 16, 1873, I read a biographical sketch of him

before the American Ethnological Society of New York, a few extracts from which I will introduce.

John Torrey, M. D., LL.D., was born in New York, August 15, 1796, and died March 10, 1873. He was distinguished for his great purity and probity of character, for his sympathy with every worthy cause, and for his contributions to human learning. His life-pursuits were chemistry, mineralogy and botany. When he began his scientific career, these sciences were in their infancy. It was his great pleasure to observe their gradual development, and to take an active part with the scientific men of both hemispheres in raising them to their present elevated position.

Graduating in Medicine in 1818, he was appointed, six years after, Professor of Chemistry, Geology and Mineralogy in the Military Academy at West Point. In 1827, he was called to the chair of Chemistry in the College of Physicians and Surgeons in this city, which he filled with honor to the college, till 1855. From 1830 to 1853, he was Professor of Chemistry at Nassau Hall, Princeton, and was associated with Joseph Henry, the Alexanders, and other distinguished men of that Institution. In 1853, he was appointed by the government Chief Assayer in the United States Assay Office at New York. He was also appointed Professor of Botany in Columbia College in this city, to which he has left his immense collection of plants, which is probably one of the most valuable in the world, especially in American botany.

The Annals of the Lyceum of Natural History of New York, of which he was one of its founders, show his industry in his early scientific course. These are the titles of some of his papers: "Description of some new and rare plants from the Rocky Mountains," read before the Lyceum, September 22, 1823. Another paper on the same subject, read December 11, 1826, in which year he was elected President of the Lyceum. "Chemical Examination of some Minerals, chiefly from America, by Thomas Thompson, notes by John Torrey," read November 5, 1827. "Discovery of Vauquelinite, a rare ore of Chromium," read April 27, 1835. "Monograph of North American Cyperaceæ," read August 8, 1836. The General Index of Silliman's *Journal*, first series, gives a catalogue of papers from his pen, some of which

are as follows: "On the Condensation of Carbonic, Sulphurous and Chloro-chromic Acid Gases;" "On Staurotide;" "On Siderographite;" "Number of Indigenous Plants of New York State;" "On West Point Minerals," &c., &c.

His more important and valuable contributions are the following: "Catalogue of Plants to be found in a radius of thirty miles around New York," published in 1819; "Flora of the Northern and Middle States," 1824; "Flora of the State of New York," 2 vols., 1843-44; "Appendix to Dr. John Lindley's Introduction to Botany," 1831. He also edited, with Dr. Asa Gray, "The Flora of North America." His more important and valuable papers are to be found in the Smithsonian Contributions, and in the various government, railway and other explorations.

Dr. Torrey was an honored member of this Society. By his gentle manner and pleasing conversation, he endeared himself to us all. He had a magnetism which drew and a sympathy which touched all hearts. Associated with De Witt Clinton, Albert Gallatin, Samuel L. Mitchell and Gulian C. Verplank in the early history of the Society, he has indelibly impressed himself upon the scientific thought of the American people. He has opened mines of thought and influence which can be wrought in all time to come. Let us cherish his memory and emulate his example.

One of the greatest lights of this century is Charles Robert Darwin. I cannot hope in the limited space allotted me to do more than allude to the great work of this foremost man of science of this or any other age. Born, February 12, 1809, and dying, April 19, 1882, he finished his renowned scientific career in one of the most remarkable periods of human history. It is difficult to know which to praise most in this great biologist, his methods or their results. He was eminent in observing the habits of plants and animals and their relations to each other. He studied the variations of species under domestication and in a state of nature. He studied hybridity and the effects of hereditary and growth force. He did little in comparative anatomy and scarcely anything in embryology. His method was the inductive. He relied upon facts and not upon theoretical speculations. In 1859 appeared his

great work on "The Origin of Species." The theory may be thus stated :

Every kind of animal and plant tends to increase in numbers in a geometrical progression.

Every kind of animal and plant transmits a general likeness, with individual differences, to its offspring.

Every individual may present minute variations of any kind and in any direction.

Past time has been practically infinite.

Every individual has to endure a very severe struggle for existence, owing to the tendency to geometrical increase of all kinds of animals and plants, while the total animal and vegetable population (man and his agency excepted), remains almost stationary.

Thus, every variation of a kind tending to save the life of the individual possessing it, or to enable it more surely to propagate its kind, will in the long run be preserved, and will transmit its favorable peculiarity to some of its offspring, which peculiarity will thus become intensified till it reaches the maximum degree of utility. On the other hand, individuals presenting unfavorable peculiarities will be destroyed. The action of this law of Natural Selection may be represented by the expression, "Survival of the fittest."

This conception of Mr. Darwin's is perhaps the most interesting theory, in relation to Natural Science, which has been promulgated during the present century. In a remarkable manner it groups together a vast and varied series of biological facts, and even paradoxes, which it appears more or less clearly to explain. By this theory of "Natural Selection," light is thrown on the more singular facts relating to the geographical distribution of animals and plants; on the resemblance between the past and present inhabitants of different parts of the earth's surface.

His second great work, on "The Descent of Man," appeared in 1871. I have not time to speak of this work as I would like. It produced a profound sensation among scholars. It was looked upon as positively infidel in its teaching, and was condemned by the clergy. It presented evolution in a new phase. It was said to



teach that man, in the process of evolution, came directly from the monkey. Mr. Darwin was caricatured. Pictures of him, with caudel attachment, were put upon the market. But time has vindicated the reputation of the great scientist. Prejudice has yielded to admiration. The clergy are of one accord in their readiness to do him honor. His remains were buried in the great mausoleum of Westminster Abbey. His pall-bearers were, James R. Lowell, the Duke of Argyle, Lord Derby, Professor Huxley, Sir Joseph Hooker, Sir John Lubbock, Alfred R. Wallace, Mr. Spottiswood, President of the Royal Society, and Canon Farrar.

The English Church has shown great wisdom in thus honoring this distinguished scientist. By giving his bones a resting place in the most renowned of English sepulchres, they have removed a strong and growing prejudice from the minds of that large and influential class of scientific men who are doubtless the leading thinkers and workers of this generation. It was politic to recognize this class of men. The church needs the vitalizing forces of thought and action that are outside of itself, to redeem it from a species of monasticism which is sure to spring up in a life of seclusiveness from the world. By this act of the church, the interests of science and religion are conserved. The priest at the altar and the scientist in his painstaking investigations, alike honor the cause of truth.

This was once true of the Roman Catholic Church. If any man became distinguished in science, arts or letters, he was canonized at death, and admitted into fellowship with the saints. So long as this was done the church maintained its supremacy; but when it became non-sympathetic and persecuting, it lost its power.

The *English Medical Press and Circular* says: "There is but one appropriate resting-place for the greatest naturalist in the world—the founder of the modern school of biology, the most illustrious scientific *savant* of the century—and that place is amidst those who are, by right, regarded as the creators of our intellectual superiority—in the national fane at Westminster."

"He was," said Canon Prothero, at Westminster Abbey, "the greatest man of science of his day; but was so entirely a stranger to

intellectual pride and arrogance, that he stated, with the utmost modesty, opinions, of the truth of which he was himself convinced, but which, he was aware, could not be universally agreeable and acceptable. Surely, in such a man, lived that charity which is the very essence of the true spirit of Christ."

Canon Liddon, in his sermon at St Paul's, observed, "that when Professor Darwin's books on the Origin of Species and on the Descent of Man appeared, they were largely regarded by religious men as containing a theory necessarily hostile to religion. A closer study had greatly modified any such impression. It is sure that, whether the creative activity of God is manifested through catastrophes, as the phrase goes, or in progressive evolution, it is still His creative activity, and the really great questions beyond remain untouched. The evolutionary process, supposing it to exist, must have had a beginning: who began it? It must have had material to work with: who furnished it? It is itself a law or system of laws: who enacted them? Even supposing that the theory represents absolute truth, and is not merely a provisional way of looking at things incidental to the present state of knowledge, these great questions are just as little to be decided by physical science now as they were when Moses wrote the Pentateuch; but there are apparently three important gaps in the evolutionary sequence, which it is well to bear in mind. There is the great gap between the highest animal instinct and the reflective self-measuring, self-analyzing thought of man. There is the greater gap between life and the most organized matter. There is the greatest gap of all between matter and nothing. At these three points, as far as we can see, the Creative Will must have intervened otherwise than by the way of evolution out of existing materials—to create mind, to create life, to create matter. But, beyond all question, it is our business to respect in science, as in other things, every clearly ascertained report of the senses; for every such report represents a fact, and a fact is sacred as having its place in the Temple of Universal Truth."

The *Observer* says: "We may be asked, of course, what it is, after all, that Darwin has done? He has not invented an electric

light, or a vacuum break, or thrown a viaduct across a valley, or tunnelled under a strait, or discovered some marvellous method by which to convert brewers' refuse into bread. He has done nothing for which he could have taken out a patent, or have started a joint stock company with limited liability. But he has lived from the first in an air higher than that where money is made, and professional chairs are given away. And living thus, purely, simply and honestly, he has left his mark indelibly upon human thought; the history of human thought being, for each and for all of us, the history of the universe. Peerages and decorations are conferred upon men who successfully conduct negotiations in the sugar trade, or wage war, with the Martini-Henry rifle, against naked savages. Darwin enjoyed no such distinction. Certainly he never coveted it. He was never made commissioner of anything. His whole life was one continual worship of truth for its own sake. He was incapable of jealousy, ambition or self-seeking, and—though he himself knew it not—*the moral lesson of his life is perhaps even more valuable than is the grand discovery which he has stamped on the world's history.*"

Sir. Charles Lyell, in his *Antiquity of Man*, quotes a saying of Professor Agassiz, that whenever a new and striking fact is brought to light in science, people first say "it is not true," then it is contrary to religion, and lastly, "that everybody knew it before." If a sermon delivered in St. Paul's by Canon Liddon may be accepted as evidence, the theory of evolution has passed through the two first stages of Agassiz' process, and is already on its way to the third. From the extracts from his sermon, it will be seen that the eloquent Canon accepts Darwinian theories only with reservations. His remarkable words only need to be carried to their legitimate issue, to indicate the basis on which the long-looked-for reconciliation between science and religion will be possible.

The following extracts from Continental papers may not be out of place:

The *Gaulois* remarks "that Darwin will remain one of the greatest glories of science. No other man has, during the second half of this century, exercised a more decisive and fruitful

influence on the progress of natural science. No one else has so much honored science by the nobility of his character, by the primitive simplicity of his life and by his deep and sincere love of truth."

The *France* observes: "Darwin's work has not been merely the exposition of a system; but, as it were, the production of an epic—the greatest power of the genesis of the universe, one of the grandest that ever proceeded from a human brain—an epic magnificent in its proportions, logical in its deductions and superb in its form. Darwin deserves not only a place by the side of Leibnitz, Bacon, or Decartes, but is worthy to rank with Homer."

The *Cologne Gazette* says: "He was a man of science, who made a mark upon his times in a manner unparalleled by any of his contemporaries. He compelled every branch of science to acknowledge his revolutionizing discoveries. The completion of his gigantic system will give abundant occupation to the remotest generations; but the memory of the founder of this prodigious scientific structure will remain imperishable to all time."

We cannot more fitly close this sketch than by quoting from an article in *Nature*, by Prof. Huxley:

"In France, in Germany, in Austro-Hungary, in Italy, in the United States, writers of all shades of opinion, for once unanimous, have paid a willing tribute to the worth of our great countryman, ignored in life by the official representatives of the kingdom, but laid in death among his peers in Westminster Abbey by the will of the nation.

"It is no secret that, outside that domestic group, there are many to whom Mr. Darwin's death is a wholly irreparable loss. And this not merely because of his wonderfully genial, simple and generous nature, his cheerful and animated conversation and the infinite variety and accuracy of his information, but because the more one knew of him the more he seemed the incorporated ideal of a man of science. Acute as were his reasoning powers, vast as was his knowledge, marvelous as was his tenacious industry, under physical difficulties which would have converted nine men out of ten into aimless invalids, it was not these qualities, great as they were, which impressed those who were admitted to his intimacy



with involuntary veneration, but a certain intense and almost passionate honesty, by which all his thoughts and actions were irradiated as by a central fire.

"It was this rarest and greatest of endowments which kept his vivid imagination and great speculative powers within due bounds; which compelled him to undertake the prodigious labors of original investigation of reading, upon which his published works are based; which made him accept criticisms and suggestions from anybody and everybody, not only without impatience, but with expressions of gratitude sometimes almost comically in excess of their value; which led him to allow neither himself nor others to be deceived by phrases, and to spare neither time nor pains in order to obtain clear and distinct ideas upon every topic with which he occupied himself.

"One could not converse with Darwin without being reminded of Socrates. There was the same desire to find someone wiser than himself; the same belief in the sovereignty of reason; the same ready humor; the same sympathetic interest in all the ways and works of men. But instead of turning away from the problems of nature as hopelessly insoluble, our modern philosopher devoted his whole life to attacking them in the spirit of Heraclitus and of Democritus, with results which are as the substance of which their speculations were anticipating shadows.

"None have fought better and none have been more fortunate than Charles Darwin. He found a great truth, trodden under foot, reviled by bigots and ridiculed by all the world; he lived long enough to see it, chiefly by his own efforts, inseparably incorporated with the common thoughts of men, and only hated and feared by those who would ridicule, but dare not. What shall a man desire more than this? Once more the image of Socrates rises unbidden, and the noble peroration of the *Apology* rings in our ears as if it were Charles Darwin's farewell: 'The hour of departure has come, and we go our ways—I to die and you to live. Which is the better, God only knows.'

The following is the translation of a letter written by the late Charles Darwin in answer to an inquiry from a young student at



Jena, in whom the study of Darwin's books had raised religious doubts:

"SIR—I am very busy, and am an old man in delicate health, and have not time to answer your questions fully, even assuming that they are capable of being answered at all. Science and Christ have nothing to do with each other, except in as far as the habit of scientific investigation makes a man cautious about accepting any proofs. As far as I am concerned, I do not believe that any revelation has ever been made. With regard to a future life, every one must draw his own conclusions from vague and contradictory probabilities. Wishing you well, I remain, your obedient servant,

"Down, June 5th, 1879.

CHARLES DARWIN."

Mr. Darwin was not regarded as a Christian; but he had the greatest respect for all that was good in Christianity, and was great enough to acknowledge it. This is the way in which he answered some shallow critics of foreign missionaries: "They forget, or will not remember, that human sacrifices, and the power of an idolatrous priesthood; a system of profligacy unparalleled in any other part of the world; infanticide, a consequence of that system; bloody wars, where the conquerors spared neither women nor children—that all these have been abolished; and that dishonesty, intemperance and licentiousness have been greatly reduced by the introduction of Christianity. In a voyager to forget these things is base ingratitude; for should he chance to be at the point of shipwreck on some unknown coast, he will most devoutly pray that the lesson of the missionary may have extended thus far."

It will perhaps be objected that the theory of descent has already been sufficiently established by Darwin. It is true that his newly-discovered principle of selection is of the very greatest importance, since it solves the riddle as to how that which is useful can arise in a purely mechanical way. Nor can the transforming influence of direct action, as upheld by Lamarck, be called in question, although its extent cannot as yet be estimated with any certainty. The *secondary* modifications which Darwin

regards as the consequence of a change in some other organ, must also be conceded. But are these three factors actually competent to explain the complete transformation of one species into another? Can they transform more than single characters or groups of characters? Can we consider them as the sole causes of the regular phenomena of the development of the races of animals and plants? Is there not perhaps an unknown force underlying these numberless developmental series as the true motor power—a “developmental force,” urging species to vary in certain directions, and thus calling into existence the chief types and subtypes of the animal and vegetable kingdoms?

The theory of selection by no means leads, as is always assumed, to the denial of a teleological Universal Cause and to materialism. Mechanism and teleology do not exclude one another; they are rather in mutual agreement. Without teleology there could be no mechanism, but only a confusion of crude forces; and without mechanism there could be no teleology, for how could the latter otherwise effect its purpose?

Von Hartmann correctly says: “The most complete mechanism conceivable is likewise the most completely conceivable teleology.” We may thus represent the phenomenal universe as such a completely conceivable mechanism. With this conception vanish all apprehensions that the new views would cause man to lose the best he possesses—morality and purely human spiritual culture.

Let us take our stand boldly on the ground of new knowledge and accept the direct consequences thereof, and we shall not be obliged to give up either morality or the comforting conviction of being part of an harmonious world, as a necessary member capable of development and perfection.

Any other mode of interference by a directive teleological power in the processes of the universe than by the appointment of the forces producing them, is, however, at least to the naturalist, inadmissible. We are still far removed from completely understanding the mechanism by means of which the organic world is evoked; we still find ourselves at the very beginning of knowledge.

Astronomical science has been cultivated with remarkable success. The *Mécanique Céleste*, by Pierre Simon Laplace, was published in Paris (complete edition) in 1843. The object of the author was to reduce all the known phenomena of the system of the world to the law of gravity, by strict mathematical principles, and to complete the investigations of the motions of the planets, satellites and comets begun by Newton in his *Principia*. This he accomplished in a manner deserving the highest praise for its symmetry and completeness. A work which will be classed with the *Almagest* of Ptolemy, the *De Revolutionibus Orbium Cœlestium* of Copernicus and the *Principia* of Newton—the greatest works on Astronomy. But Laplace was indebted to Leibnitz for the instrument by means of which he was able to accomplish his immortal work. I refer to the *Differential and Integral Calculus* of Godfrey W. Leibnitz, which was published in the “Leipsic Acts,” third volume, in 1684, under the following title: “*Nova Methodus Pro Maximis et Minimis, itemque tangentibus, quæ nec fractas, nec irrationales quantitates moratur et singulare pro illis calculi genus, per G. G. L.*” In the brief space of six and a half pages is condensed this mighty instrument of mathematical analysis.

Nathaniel Bowditch, of Boston, translated part of the *Mécanique Céleste* with a commentary, in four volumes—the last volume, in 1839. Additions to the original are so extensive and important as to entitle him to be ranked in the first class of writers on the higher mathematics.

M. Legendre, in 1832, wrote Bowditch: “Your work is not merely a translation with a commentary; I regard it as a new edition, augmented and improved, and such a one as might have come from the hands of the author himself.” M. Bessel wrote in 1836: “Through your labors on the Mechanism of the Heavens, La Place’s work is brought down to our own time, as you add to it the studies of geometricians since its first appearance.” Lacroix, Puissant, Babbage and others wrote similar letters of commendation.

Benjamin Peirce, late professor in Harvard College, was a prolific writer on mathematics. The most distinguished mathe-

matical school in this or any other country, is now in session at John's Hopkins College, Baltimore, under the direction of J. J. Sylvester, aided by Prof. Arthur Caley, of Cambridge, England, two of the greatest living mathematicians. In 1858, was published Sir William Rowan Hamilton's *New Mathematical Method, or Calculus of Quaternions*.

To the Academy of Sciences at Paris we are indebted for magnificent editions of the complete works of Laplace and of Lagrange. The Government of Norway has given us the celebrated *Memoirs of Abel*; the Academy of Gœttingen the works of Gauss and Riemann; the Academy of Berlin, editions of the works of Steiner and Jacobi; in England, the collected mathematical works of Clifford, MacCullagh, Green, Gregory, Leslie Ellis and of Macquorn Rankine; and in our own country, of Benjamin Peirce. The results of mathematical research are usually found in the *Transactions of Societies*, or in periodicals specially devoted to mathematical writings.

Speculation in pure mathematics resembles metaphysical speculation in this, that the whole universe of thought to which it refers is so closely interdependent, that a clear-sighted and powerful thinker cannot fix his mental vision (however keen his effort after concentration may be) on any one region in it, without catching glimpses of something that lies beyond, and without discovering; more or less dimly, new relations to be examined, and new lines of research, which may perhaps have no immediate relevancy to the particular enquiry in which he is engaged. And these glimpses, if recorded, or even if only half unconsciously indicated, in the account which he afterwards gives of his work, are not unlikely to suggest a wholly new departure to some kindred spirit in a future time.

One of the most remarkable triumphs of mathematical analysis was achieved by two young men in 1845 and 1846—John Couch Adams of England and Urbain Jean I. Le Verrier of France. They formed a design of investigating the irregularities in the motion of Uranus, in order to find out whether they might be attributed to the action of some unknown planet, and thence, if possible, to determine approximately the elements of its orbit.



The extreme difficulty of the problem may to some extent be appreciated when we remember that it is the inverse of the ordinary problem of perturbations. Given the positions and movements of the planets, the great mathematicians of the last century had found it sufficiently difficult to calculate the perturbations; but given the perturbations, it was a far harder problem to find the mass, the mean distance of the perturbing body, together with the eccentricity and plane of its orbit, the direction of its line of apses and the position, at a particular moment, of the planet in its orbit. Mr. Adams' investigation was based on the observed error in longitude of the motion of Uranus. M. Le Verrier's, on the theory of Uranus, in which its perturbations were explained by the attraction of a planet whose motion and mass were determined to be the same as those found by Mr. Adams.

The problem was the solution of a series of simultaneous partial differential equations with nine unknown quantities, namely, the mass, mean distance, eccentricity, epoch, and perihelion longitude of the working planet, and the corrections to the latter four elements of Uranus. The smallness of the perturbations in latitude showed that the inclinations and nodes might be neglected, or, otherwise, the number of unknown quantities would have been thirteen. It will be seen that the impossibility of solving such a problem by any ordinary mathematical methods and even the Planetary Theory, evolved by the genius of Laplace and Lagrange, failed in application in consequence of the inverse character of the problem.

These astronomers were unacquainted with each other and knew nothing of each other's work. Adams was the first to complete his computations, which was in September, 1845. These were sent to the Greenwich Observatory for verification; but, unfortunately for Mr. Adams, the Astronomer Royal requested him to make some further calculations, with a view of confirming his results. While he was engaged on that, M. Le Verrier published the results of his calculations on the 1st of June, 1846. As they agreed exactly with those of Mr. Adams, Prof. Airy wrote to Prof. Challis, of the Cambridge Observatory, requesting him to make a careful search with the great Northumberland refractor. But it



was too late. M. La Verrier had written to his friend Dr. Galle of Berlin, to direct his telescope to that point in the heavens which his computations had suggested as the probable locality of his hypothetical planet. The request was complied with, and on the 23d of September, 1846, a star of the eighth magnitude was discovered, which was not found on any accurate map of the heavens, including all the stars of that magnitude. The next evening, the telescope was again directed to the star in question, and it had swerved from its former position, in a direction and with a velocity almost entirely accordant with the theory of the French geometer. The planet Neptune was found!

The Council of the Royal Society doubted whether their annual medal was due to Mr. Adams or to M. Le Verrier; but, ultimately, as there was no precedent in favor of bestowing a double medal, they decided on conferring a testimonial on each claimant instead. The testimonial reads: "For his researches in the problem of inverse perturbations, leading to the discovery of Neptune."

This was an injustice to Le Verrier, who was fairly entitled to the medal, which, in every case, is determined by *priority* of publication.

In connection with the labors of these astronomers in relation to Neptune, it is proper that I call attention to Sears C. Walker, formerly of the United States Coast Survey, who determined the orbit of Neptune, confirming the identity of Neptune and the star of Lalande by an examination of Lalande's manuscripts, in Paris. Benjamin Peirce made a searching investigation of the theory and redetermination of the perturbations which gave Walker the means of obtaining an orbit yet more rigorously exact. And thus by the joint labors of these American astronomers, the theory of Neptune was placed, within eighteen months after the discovery of the planet, on a sure and accurate basis, which completes the verification of the true theory of physical astronomy, and is an addition to our knowledge of formal astronomy. To this branch of the subject, we have only to add the discovery of the fifth satellite of Saturn, raising the whole number to eight, simultaneously made by Prof. Bond and Mr. Lassell, on the 19th of September, 1848; the discovery of two more satellites to Uranus, by Lassell in 1847; the

discovery of a satellite to Neptune, by Lassell, in October, 1846; the late discovery of two satellites to Mars, by Prof. Asaph Hall, at Washington, in August, 1877.

So that round most of the planets revolve satellites in nearly circular orbits. Of these the earth has one; Mars two; Jupiter four; Saturn eight besides a ring; Uranus certainly four; and Neptune certainly one.

The logical consequence of the law of gravitation is, that the planets and satellites ought to move in ellipses, with the primary in a focus of each, according to Kepler's laws, and perturb one another in a certain way, all of which agrees with observation. But what its plane should be, which way the planet should move in its orbit; of these the law of gravitation tells us nothing. These all depend in each case on the way the body was originally started in its course.

Now, in all the bodies of the solar system, with the exception of the satellites of Uranus and Neptune, we observe a very remarkable similarity in these respects. The orbits of all the planets and satellites are very nearly circles, and nearly in the same plane. All the planets and satellites rotate on their axes and revolve in the same direction. This seems to point to some common cause of their original starting on their courses. Laplace calculated that the odds against this being *accidental*—against, that is, each body having had an entirely isolated and separate physical cause of its original motion—was many trillions to one. It is, therefore, practically certain that there must be some one physical cause of the original motions of all the bodies of the solar system; and Physical Astronomy is not complete until we have discovered what that cause is.

I present another astronomical problem which for years interested Herschel—the determination of the great centre of our sidereal stratum. By examining the old charts, he found the stars not fixed, but perpetually changing their places, and show, as the change may be, the accuracy with which modern instruments measure minute distances, enables the astronomer not only to ascertain the rate of motion, but the actual direction in which the object is moving. When Herschel found these changes going on,

the idea occurred to him that probably the change was parallactic, and that the sun, with all its planets and comets, was speeding through space. He commenced his examinations to see if this supposition was correct, when he arrived at a result, the most astonishing that was ever unfolded by the mind of man. He found that, if he was only permitted to accept the hypothesis that the sun was sweeping toward a certain point in the constellation Hercules, he could account for a large proportion of the changes of the fixed stars all through the heavens. But when other astronomers gave their attention to this subject and found it too difficult for examination, the theory seemed to die away, doubts were cast upon its results, and astronomers finally rejected it. At length, it was taken up in Russia. Argelander undertook the solution of this problem. The grand object was this—to show how it was that the grand point in the heavens, toward which the sun is moving, was determined.

Argelander began his investigations by the observation of five hundred stars, selected in different points in the heavens, which he compared with the observations of the oldest astronomers. Let us suppose, for the sake of illustration, that he finds the star selected for observation, to-night, was located in a certain point in the heavens one hundred years previous to his time; and that, at the time he makes his observation, it is located here in another point in the heavens. Now, the distance which the two points are separated from each other being known, it is very easy to ascertain the star's rate of motion. Now then, having accomplished this with reference to every one of these stars, he finds them all converging to a certain part of the heavens, as if that were the point toward which the sun is moving. It must be that the line of direction in which the star moves makes an angle with the meridian, which is an observed angle. It is observed because it is formed by the joining of two points, occupied by the star, when observed by the ancient and modern astronomers. Now, inasmuch as all these appeared to point at some spot toward which the sun is moving, he adopted a point and said, "Now, if the sun is going to that point, I can predict the line of direction in which every star appears to move." He compared his computed angles with his

observed ones in every instance; and, if he finds any discrepancy between them, he assumes a new point. And thus he continued to take one point after another, until all the conditions of the problem were fulfilled, and he said, "There is the point."

The subject was then taken up by Struve, son of the celebrated astronomer who was in charge of the great observatory at Pulkowa. He wished to know the swiftness of the sun's motions through space. In demonstration of his wonderful discoveries, and as a result, he shows that the sun is actually moving at the rate of 200,000 miles per hour. These two points having been determined, may not the sun be circulating around some grand central orb? May not the fixed stars be whirling their endless cycles round some grand point, the centre of the whole?

This was the problem that Maedler, the successor of Struve, undertook to solve. Is there a grand central orb? Is there a stupendous Globe occupying the centre of our Island Universe, having the same proportion to the whole mass that the sun does to our system. We can look out into space in every direction—we can examine the stars and their motions—we can, therefore, detect such a region—we can detect the exact point where it is located, if any such motions as we have described exist—and the conclusion is that no such globe exists.

The next question is this: Is there no centre of gravity about which all the mighty host of suns, stars and comets circulate obedient to its laws. His answer was that there is; and it was to the solution of this problem that Maedler gave the energies of his intellect. After long years of labor, after he had almost exhausted the capabilities of analysis, after bringing to bear upon the problem all the mighty influences of science and art, after ranging from point to point in the heavens which he was compelled successively to abandon, he turned his attention to the examination of the beautiful group of stars called the Pleiades. After watching their movements until he had computed the rates of motion of the principal stars in this group, and the direction in which they were journeying, he found to his great delight that they fulfilled all the conditions of the problem, and the grand result was attained. The truth came irresistibly upon his mind, that *there* is the

centre, and *that* is the point about which all the bright hosts of heaven are sweeping, in periods which actually stun the human mind. Maedler has computed the periodic time of our own sun, which gives this astonishing result. It takes our sun 218,000,000 of years to complete its stupendous cycle.

This was the result to which Maedler's studies brought him. But, unfortunately, there is no proof that this view is correct. No other astronomer at the present time holds to this doctrine of Maedler. It is known that a great many stars are collected into clusters; but there is no evidence that the stars of these clusters revolve in regular orbits, or that the clusters themselves have any regular motion around a common centre.

But still, in addition to all the motions of the earth, its diurnal rotation, its annual revolution round the sun, the rythmical swaying of its axis, proved by the precession of the equinoxes, the mutation or more rapid swaying which is caused by the attraction of the moon, there is an enormous translating movement which is dragging it through endless tracks of space in the train of the sun. Not many years ago, as I have said, this motion was entirely unknown to astronomers, and yet it is going on with an inconceivable rapidity—a rapidity more than double that of the course of the planet round its central luminary. In one second of time the earth moves about forty-four miles toward the point of the heavens where we find the constellation of Hercules. During one year only, she travels 1382 millions of miles in this direction (Bessel). Does this enormous distance—which light itself would take two hours and five minutes in traversing—form part of an ellipse described by the whole planetary system round some centre of attraction—a centre which Maedler has fancied that he had discovered in Alcyone, in the midst of the Pleiades? Or is it, as Carus supposes (*Natur und Idee*), a portion of an orbit which has for its focus (like the curves of multiple stars) a centre of gravity common to many stars—nothing but a mathematical point everlastingly changing in infinite space? We cannot tell; but certainly this movement of the globe we live on, and its progress through the unfathomable depths of space, must give us an idea of the immense variety of the motions which make the heavenly bodies



gyrate like particles of dust in a whirlwind. Our own little earth itself is carried on from space to space, and never closes the cycle of its revolutions. Ever since the time when its particles were first grouped together, it has been describing in space the infinite spiral of its ellipses, and thus will go on turning and oscillating in ether until the moment when it will exist no longer as an independent planet. For the earth, too, must have an end; like every other body in the universe, it comes into existence and lives only to die when its time comes. Already its annual motion of rotation is diminishing in speed (Meyer, Joule, Tyndall, Adams, Delaunay); certainly, this slackening of pace is not very observable, since no astronomer from Hipparchus to Laplace has yet exactly defined it. But unless some cosmical force acting in a contrary direction compensates for the loss of speed caused by the friction of the tides against the bed and shore of the ocean, the impetus of our planet will every century diminish. After various catastrophes which it is impossible to foresee, the earth will eventually completely change its course of action and lose its independent existence, either uniting itself with other planetary bodies, or breaking up into fragments; or it will perhaps terminate its course by falling like a mere areolite upon the surface of the sun.

In the winter of 1877, I visited Padre Secchi at his Observatory in Rome, and saw the instruments with which he had done so much for astronomy. He had two refractors—one of 6 inch and the other of  $9\frac{1}{2}$  inch aperture. With the former, he had made all his observations upon the sun's disc; and, with the latter, his spectroscopical examinations of some five hundred stars. He used Rutherford's diffraction grating, of which he spoke in the highest terms of praise.

I showed him Eaton's prism for direct light made of heavy glass and of great dispersive power. He took it into a dark room and let the sunlight through a slit in the shutter fall upon the prism, and the dark lines of the spectrum stood out in bold relief. He had never seen the like. So pleased was he with the prism, I gave it to him. On my return to the city, he had it mounted and obtained spectra of Sirius, Alpha Orionis. The dispersion was wonderful, he

said, too great for spectroscopic work on faint bodies. He gave me his catalogue of the stars and drawings of his telescope. February 10th, he called and invited me to visit the observatory and meet Dom Pedro of Brazil. I went and saw the spectrum of Sirius, across which were two dark lines in the blue and one in the yellow: saw the spectrum of Beltegeuse, in which there were a great many lines.

The study of the double and multiple stars has occupied the attention of many astronomers. In 1861, Otto Struve began his observations, and from year to year made careful and systematic measures of the most important double stars, which have been published in two volumes.

With an 8 foot equatorial, Admiral Smyth measured 680 stars between 1830 and 1843, the results of which were published in 1844; and, in 1860, his "*Speculum Hartwellianum*," containing later measures, was published.

Mäedler, with the Dorpat refractor, measured a large number of double stars between 1834 and 1845, and published the results in 1847 in an elaborate work.

Dawes published his great catalogue of double stars in 1867. Powell and Jacob, at Madras; Dembouski, at Naples; Secchi, at Rome; Dunér, at the Lund Observatory; Stone, at the Cincinnati Observatory; Burnham, of Chicago; Dr. Peters, Director of the Litchfield Observatory of Hamilton College, and many others, have published catalogues of these interesting objects. The sidereal charts of Peters, on which he has labored for a period of twenty-two years, will be of immense value to future astronomers. His maps include many thousands of telescopic stars—stars which are found on no other charts—stars of the fourteenth magnitude.

Many other observers in this department of astronomy might be mentioned, but time fails.

These observations could not have been made, had it not been for the wonderful improvement in the construction of refracting telescopes. Among the most noted of these instruments may be mentioned, the Dorpat, made by Fraunhofer; Dawes' Equatorial, by Alvin Clark & Sons, aperture  $8\frac{1}{4}$  inches; Northumberland Equatorial Cambridge, objective by Cauchoix, aperture  $11\frac{1}{2}$  inches,

Observer, Challis'; Cambridge (U. S.) same as Poulkova refractor, aperture 15 inches, Observer Pickering; Greenwich, object glass by Merz & Son, has an aperture  $12\frac{1}{2}$  inches; Cincinnati, begun by Fraunhofer, and finished by Merz & Mähler, aperture 11 inches; Chicago, Dearborn Observatory, refractor made by Alvin Clark, aperture  $18\frac{1}{2}$  inches. The great refractor at Washington, the glass by Chance, makers Alvin Clark & Sons, aperture 26 inches, focal length 390 inches. Observers, Newcomb, Hall and Holden.

It was with this magnificent refractor that Prof. Asaph Hall discovered the moons of Mars. On the 11th of August, 1877, he found the outer satellite; on the 17th he saw it again, and soon after the inner one came out.

The first college astronomical observatory in this country was established at Williams College in 1838, under the direction of Prof. Albert Hopkins. Another was erected at Hudson, Ohio, in 1839. In 1840, an observatory was added to Girard College in Philadelphia. In 1843, an observatory was commenced at Cincinnati by Prof. O. M. Mitchell, and completed in 1845. In 1844, the Cambridge Observatory at Harvard University was erected on Sumner Hill.

Since that time, almost every college of any importance has its observatory and astronomical instruments.

The Litchfield Observatory of Hamilton College is under the direction of Prof. C. H. F. Peters, who is one of the most successful discoverers of the smaller planets.

It is remarkable that the Greenwich Observatory has never, we believe, announced a single discovery of a planet, nor indeed proposed such an object for its great work. It is the faithful, exact and long continued series of observations of the moon and the larger planets and fixed stars, made by this observatory, which, in connection with those of other observations, has already done so much for the great purposes of navigation.

Dr. B. A. Gould, who organized the Dudley Observatory at Albany, founded at Cordova, under the auspices of the Argentine Republic, a splendidly equipped observatory. In his "Uranometry of the Southern Heavens," he has included all stars visible to the naked eye, the magnitude of each star being determined by not

less than four independent observations. His great telescopic work has been done with Tolles 5-inch telescope. In speaking of the star of Eta Argus, he says: "In the field of my small 'Tolles' telescope of 5-inch aperture and 35-inch focal length, it is a conspicuous object, and prominent by its ruddy color among the cluster of which it forms a part." The magnificence of the milky way in this vicinity is indescribable, surpassing the Pleiades or the Præsepe in richness, and exhibiting numerous huge clusters, the sight of which, through the Tolles telescope, evokes exclamations of astonishment and delight from every beholder.

There are several valuable private observatories in this State where admirable telescopic work has been done. The oldest and not the least conspicuous is that of Louis M. Rutherford, Esq., of New York, who was among the very first to prosecute the subject of celestial photography. With a specially constructed photographic objective, he took, March 6, 1863, remarkably fine negatives of the moon, the best ever taken. His ruling upon glass and speculum metal for the diffraction of light has been turned to excellent account in spectroscopic analysis of the stars and nebulae.

Dr. Henry Draper, of the University of New York, has a private observatory at Hastings on the Hudson, and has been successful in taking photographs of stellar and planetary spectra. He has photographed the spectra of Venus, Mars and Jupiter, and no difference can be detected between the spectra of these planets and the spectrum of the sun. At Rawlins, Wyoming, July 29, 1878, he photographed the total eclipse of the sun, using a Rutherford grating two inches square and a camera of large aperture, and obtaining a photograph of the spectrum of the Corona. The main part of the work of his party was to make photographic, spectroscopic and thermo-electric observations, and they were quite successful. He also photographed the comet of 1881. A photograph of its spectrum shows elements and colors which the eye cannot discern in the visual spectrum. The tail of the comet shows a continuous spectrum, indicating that the tail is composed of solid or liquid substances.

Dr. Draper was the first to obtain photographs of the fixed lines in the spectra of the stars—the first to get a photograph of

the great Nebula in Orion. He took a photograph of the moon near its third quarter of nearly four feet in diameter. The moon is a difficult object to photograph, because she travels in an hour over her own diameter. She don't stand still, and must be taken on the wing.

It must be borne in mind that Draper has made his spectroscopic and photographic discoveries in the celestial bodies by means of telescopes made with his own hands. He made two silvered glass reflectors, which were equatorially mounted—the first of  $15\frac{1}{2}$  inches aperture, the second 28 inches aperture—marvels of successful mechanism for an amateur instrument-maker.

Much is to be expected in the future development of the physical constitution of the universe from this brilliant and hard working young astronomer.

Another laborious and successful observer is Prof. Lewis Swift, of Rochester, who has done excellent work.

When we graduated, only four of the small planets had been discovered. The first, "Ceres," by Piazzi, in 1801. Now the number has been increased to two hundred and twenty! Of these, Peters of Hamilton College has discovered forty!

The number of observatories at present known in the world, is 118—84 are in Europe, 2 in Asia, 2 in Africa, 27 in America, and three in Oceanica. Of the European observatories, Prussia has 29; Russia, 19; England, 14; Italy, 9; Austria, 8; France, 6; Switzerland, 4, Sweden, 3; Spain, Portugal, Holland and Norway, each possesses two, while there is only one in Greece, Belgium and Denmark. The most ancient observatory in Europe, and in the world, is that of Leyden, having been founded in 1632; then comes Copenhagen, founded in 1637; Paris, in 1667, and Greenwich, in 1675. The Moscow Observatory is the oldest in Russia, dating from 1750; Prussia, now the richest country in the world in astronomical observatories, had none before 1805.

In 1872, Signor Schiaparelli received the gold medal of the London Astronomical Society for his contributions to Meteoric Astronomy. The theories of Schiaparelli are directly based on observations and mathematical calculations which bring them under the domain of the recognized logic of mathematical probability.



I can only state the general results, which are that the meteors which we see every year more or less abundantly, and which always appear to come from the same point in the heavens, are there and thus visible because they form part of an eccentric elliptical zone of meteoric bodies which girdle the domain of the sun; and that our earth, in the course of its annual journey round the sun, crosses and plunges more or less deeply into this ellipse of small attendant bodies, which are supposed to be moving in regular orbits around the sun.

Schiaparelli has compared the position, the direction, and the velocity of motion of the August meteors with the orbit of the great comet of 1862, and infers that there is a close connection between them, so close that the meteors may be regarded as a sort of trail which the comet has left behind. He does not exactly say that they are detached vertebræ of the comet's tail, but suggests the possibility of their original connection with its head.

Similar observations have been made upon the November meteoric showers, which by similar reasoning are associated with another comet; and further yet, it is assumed upon analogy that other recognised meteor systems, amounting to nearly two hundred in number, are in like manner associated with other comets.

If these theories are sound, our diagrams and mental pictures of the solar system must be materially modified. Besides the central sun, the eight planets and the asteroids moving in their nearly circular orbits, and some eccentric comets travelling in long ellipses, we must add a countless multitude of small bodies clustered in elliptical rings, all travelling together in the path marked by their containing girdle, and following the lead of a steaming, vaporous monster, their parent comet.

We must count such comets, and such rings filled with attendant fragments, not merely by tens or hundreds, but by thousands and tens of thousands, even by millions; the path of the earth being but a thread in space, and yet a hundred or two are strung upon it.

In 1851, Foucault made an experiment in the dome of the Pantheon, at Paris, to show the actual rotation of the earth. He

suspended a heavy spherical weight by a long thin wire, and set it swinging as a pendulum. There is no reason why it should change the direction in which it swings; but, if the earth rotates, carrying the room in which the pendulum swings round with it, the position of the room will change with respect to the constant direction in which the pendulum swings; and to an observer in the room who will be carried round with it, the direction in which the pendulum swings will appear to change, exactly as it might be if the earth rotated once a day.

It is generally understood that, at the pole of the earth, the plane of vibration of a free pendulum remaining constant must make an angle with the movable meridian of the place, which angle, in consequence of the rotation of the earth on its axis, continually increases, until it amounts to 360 degrees at the end of twenty-four hours; that is to say, that after a lapse of one day, the plane of vibration returns to its original position. At the equator, the plane of vibration remains always parallel to the meridian; while at all other points of the earth's surface, it makes an angle with the meridian which depends upon the latitude of the place; and, at the end of twenty-four hours, has not yet amounted to 360 degrees.

The speculations of the French philosopher, Adhemer, based on the precession of the equinoxes and the movement of the apsides, are very curious. If the movement of the earth is compared with that of the stars, it requires the lapse of 25,000 years to bring the equinox to correspond with the same point in space it now occupies; but the orbit itself being movable, this period is reduced to about 21,000 years, which is called the Great Year, being the measure or time before the winter solstice will again exactly coincide with the *perihelion*, and the summer solstice with the *aphelion*, and before the seasons will again harmonize with the same points of the terrestrial orbit.

As the earth between the vernal and autumnal equinox traverses a longer circuit than during the other half of the year, and also experiences an accelerated movement as it draws near the sun, the result is that the northern summer is longer than the southern summer by about eight days; but, after the lapse of

10,500 years, these conditions will be reversed. It was in the year 1248, according to Adhemer, that the great northern summer culminated, since which time it has continued to decrease, and that decrease will go on until the year 11,748, when it will have attained its maximum.

This compound movement, the precession of the equinoxes and the shifting of the line of the apsides, it is claimed, exerts a marked influence in the distribution of the earth's temperature.

Mr. Croll, an English physicist, has prepared tables, showing the amount of the earth's eccentricity for the period of three million of years, at intervals of 10,000 years for a greater portion of that time, and 50,000 years for the remainder. He infers that a glacial period occurs when the eccentricity of the earth's orbit is at a maximum, and the solstices fall when the earth is in perihelio and in aphelio; and that only one hemisphere has a glacial climate at the same time, which occurs when the winter is in *Aphelio*.

Ohm's law of electrical resistance, showing the relation between the current and the electromotive force in a wire or unit of resistance, is of great interest. The exact measure in metres of the column of pure mercury of one square millimetre cross-section at 0° centegrade, gives what is known as the ohm. Different values have been obtained. Kohlrausch, 1.0593; Rayleigh, 1.0624; Glazebrook, 1.0624; Weber, 1.0552; Rowland, 1.0572; Weber and Zöllner, 1.0552; and Dorlin, 1.0546. Mr. F. Weber, of Zurich, gave, at a late Congress held in Paris, the figures 1.0471 as the result of his work, and it was there resolved that the experimentors be recommended to compare (1) their standards of resistance with that produced by the French Government; (2) to compare the induction lists by the Kohlrausch wire circuit method, and (3) to give all attention to the Laurens method. Finally, it was urged that all governments should support, as far as possible, what national experiments were made for the determination of the ohm.

The doctrine of the *conservation of energy* will always mark the nineteenth century in the history of discovery, and is undoubtedly one of the greatest and grandest generalizations of modern science.

It is well known that all of the physical forces, such as heat,

light, electricity, or magnetism, are capable of being transformed into each other, and also that each of them can be made to perform mechanical work by the communication of motion to matter. All these various manifestations of force are, however, only modes or conditions of one universal energy, which underlies all the changing phenomena of the universe. This energy may be active or passive, it may be diffused or concentrated, it may assume unnumbered forms and guises, but it is one in its essential nature, and the sum of all the various forms of energy in the universe, when measured by their capacity to do work, is always a constant quantity.

It is in the ceaseless transmutation of energy from one form to another that the myriad phenomena of the universe are manifested, and in their fleeting passage we obtain the power which can drive our machines and do our work.

Energy may be defined as the power to do work, quite independent of the special form or mode in which it may be stored, or the character of the manifestation which it will exhibit during the performance of the work. Whenever energy changes its conditions it always does work, and whenever work is done, whether it is visible or invisible to the senses, an equivalent amount of energy disappears.

Stored energy is always spoken of as *potential energy*. When energy is liberated, and performing work, it is called *kinetic*, or *actual energy*, because the force is no longer stored, but in the act of being expended on work. These two states of energy, although they are widely different in their character, are easily changed from one state into the other, and all the phenomena of the physical universe are really the result of the change which is continually in operation.

#### A. ENERGY OF MASS—GRAVITATION.

- I. Visible potential energy—A raised weight.
- II. Visible kinetic energy—A falling weight.
- III. Visible potential and kinetic energy—A swinging, or vibrating pendulum.

#### B. ENERGY OF MOLECULES, OR MOLECULAR SEPARATION.

- IV. Invisible potential energy—Any confined volume of steam.

- V. Visible kinetic energy—Condensing steam, or the recoil of a bent spring.

*C. THERMO-ENERGY, OR ABSORBED HEAT.*

- VI. Invisible potential energy—Latent heat.  
 VII. Visible potential energy—Expansion of bodies when heated which can do work on cooling.

*D. ELECTRICAL ENERGY, OR ENERGY OF ELECTRICAL SEPARATION.*

- VIII. Invisible potential energy—A charged Leyden jar with interrupted circuit.  
 IX. Visible kinetic energy—An electric current fusing a wire, or driving an electro-motor.

*E. CHEMICAL ENERGY, OR ATOMIC SEPARATION.*

- X. Invisible potential energy—A mass of gunpowder.  
 XI. Visible kinetic energy—The burning of fuel, attended by light and heat.

*F. RADIANT ENERGY.*

- XII. Invisible potential energy—Any heated or incandescent body.  
 XIII. Visible potential energy—A ray of light.

Although the two states of energy—potential and kinetic—are mutually interchangeable, so that potential energy of mass may be changed into kinetic energy of motion of the mass, still there is a physical limit to this change, because kinetic energy may be expended in the performance of molecular work where the motions are too small to be recovered again as potential energy of mass. It has been experimentally proved—and in strict accordance with theory—that although it is quite possible to change all the stored energy of mass of matter, when liberated by its motion, into heat, it is not possible to reverse the process and change all the heat back again into molecular motion. There is always a certain portion of the heat frittered away, disappearing in the performance of



work amongst the molecules of matter, and which cannot be recovered by any means at present known to science.

The gradual concentration of the matter in the visible universe, which is evident in the past history of our solar system, and in the star clusters and nebulae in the far distant regions of space, is therefore slowly changing all the potential energy which was originally present in the universe into the kinetic form. This process undoubtedly points to an end to all its phenomena, unless there is some higher and exterior law in operation with which we are not at present acquainted. The ultimate form to which the kinetic energy of the universe tends is diffused heat, and when this long-protracted diffusion will have been accomplished, so that all matter will possess a uniform temperature, all motion and all life will cease. Millions of years, countless as the sand upon the seashore, will roll away before this end will come, but come it will, as surely as a clock will run down if no exterior power raise the fallen weight.

We may also point out that this same law also indicates a beginning, because the sum of the potential and kinetic energy being a constant and finite quantity, the phenomena of the universe cannot have been exhibited from all eternity, or else the potential energy would all have assumed the kinetic form. How distant the time of the beginning may be, no computation can determine any more than it can determine the time of the end; but that there has been a beginning, and that there will be an end, to the existing condition of the universe, is as certain a deduction from the present knowledge of physical causes, as any knowledge which we possess.

The dynamical theory of matter opens a wide field for speculation. It is sufficient to say that we are probably only on the threshold of our knowledge of the physical universe and its laws, and that each step which we take, while it may widen our knowledge, only reveals a still wider region, into which it is difficult, but probably not impossible, to enter. Guided by the laws which have been ascertained from rigid observation and experiments, we may rest satisfied that each step forward will be followed by increased power on the part of man to control the forces and reactions of the material world, so that in the future, as in the past,

the progress of science will be at once a cause and a proof of an advance in civilization, and will thus confer measureless benefits on mankind at large.

In concluding my remarks upon the scientific progress of the half century, I would call attention to the discovery of the two most comprehensive generalizations in physics and biology—the law of the conservation of energy and the law of natural selection. These laws furnish the most advanced scientific explanations of the physical universe.

Herbert Spencer, in his new system of evolution-philosophy, has given the most complete and philosophic statement of the scientific faith; and he has given it with special references to the above-named highest laws.

On the question of the origin and future dissolution of our earth and solar system, the most eminent physicists are in the main agreed, however much they may differ on such philosophical questions as the immortality of the soul or the existence of God. They agree that a widely dispersed nebulous matter, closing together under gravitation, awoke the sun's fires and produced the earth and planets originally at molten heat. They are further agreed in accepting Sir Wm. Thompson's doctrine of the dissipation of energy, with the consequent further dissolution of all the systems of the universe. There is a consensus of opinion amongst the foremost physicists as to the remote physical beginning and far-off end of the material universe, though they differ widely as to the nature and destiny of the human soul.

I regret that time fails me to complete in outline a general survey of what has taken place in the great circle of human enterprise during this semi-centennial. There are many subjects to which no allusion has been made, as pre-historic archæology, which has dispelled the mist of ages and made the silent past to speak—which has opened up a long vista through distant historic periods to the remotest and darkest ages, and has been defined as the history of men and things which have no history. The decipherment of hieroglyphics by Champollion; light thrown upon the ancient Egyptian religion and civilization by Lepsius, Birch, Hincks, Brugsch, Mariette, and others; the publication of Egyptian

texts, as the collections of Champollion, Rosellini, Burton's "Excerpta Hieroglyphica," Sharpe's "Egyptian Inscriptions," the magnificent "Denkmaeler" of Lepsius, the "Hieratic Papyri" of the British Museum, and many other splendid publications; "Ninevah and Its Palaces," discoveries of Botta, Layard, George Smith, and others, "Classical Antiquities;" Fellow's "Discoveries in Lycia;" Schliemann's "Troy and Its Remains;" Schliemann's "Mycenæ and Tiryns;" Dennis's "Cities and Countries of Etruria," etc., etc. Mines of wealth in Oriental literature have been opened by such scholars as Max Muller and Prof. Whitney, in the "Sanskrit," and Dr. James Legge, in "Chinese Classics." Bopp has written his "Comparative Grammar;" Norris, his "Assyrian Dictionary;" Renfey, his "Sanskrit and English Dictionary;" Winslow, his "Tamil and English Dictionary;" Medhurst, his "Chinese Dictionary."

Such works as the "Rig-Veda-Sanhita," edited by Max Muller, in 6 vols., 4mo.; "History of Assurbanipal," and "History of Sennacherib"—both translated from Cuneiform inscriptions into English by George Smith, are highly creditable to modern scholarship.

I find no time for ethnology, social science, political economy, and the fine arts, the study of which has become so universal. I may have given unwarranted consideration to some of the topics which have come under review, which is probably due to the interest I have for many years taken in them. But there never was such an intellectual awakening as we have witnessed.

The steamship and the electric cable have bridged the Atlantic. The most intimate relations are springing up between people of different nationalities. The great principles of international law are studied. The arbitrament of disputes between nations will be settled in the future by an appeal to reason rather than the sword. England and the United States—one in origin, language, religion and civilization—are vieing with each other in kindly acts of comity. The royal purple is not soiled by contact with the coarser fabrics of our American looms. Princess Louise, traversing our vast continent, does not disdain to meet on friendly terms her transatlantic cousins. Westminster Abbey, consecrated to the

sepulture of the renowned men of England, has admitted to its sacred precincts America's greatest poet! The marble bearing the inscription Henry Wadsworth Longfellow, has been placed in the Poets' Corner beside those of William Shakespeare and John Milton! All hail to English magnanimity! The Universities of Oxford and Cambridge are open to American students. England's art accumulations for centuries, at South Kensington and the British Museum, are open for the inspection and study of our citizens. Her historians and scholars, her artists, theologians and philosophers, visit our cities and speak in our lecture rooms and pulpits. The bonds which bind the two nations are daily strengthening. Together, they form the mightiest power on earth, and constitute the advancing army of the world's civilization.

But our generation has scarcely done more than enter the *vestibule* of the temple of knowledge! A grander future awaits the generations which are to follow! And yet how little, after all, can man in his greatest achievements hope to attain of the vast stores of knowledge which lie hidden in the Divine Mind! "The highest reach of human science," says Sir Wm. Hamilton, "is the scientific recognition of human ignorance.—

" *Qui nescit ignorare nescit scire.* "

"There are two sorts of ignorance. We philosophize to escape ignorance, and the consummation of our philosophy is ignorance; we start from the one, we repose in the other; they are the goals from which and to which we tend, and the pursuit of knowledge is but a course between two ignorances, as human life is itself only a travelling from grave to grave. This learned ignorance is the rational conviction by the human mind of its inability to transcend certain limits; it is the knowledge of ourselves—the science of man. \* \* \* In fact, the recognition of human ignorance is not only the one highest, but the one true knowledge; and its first fruit, as has been said, is humility. Simple nescience is not found; consummated science is positively humble. \* \* \* But as our knowledge stands to ignorance, so stands it also to doubt. Doubt is the beginning and the end of our efforts to know; for it is true. \* \* \* *Alte dubitat, qui altius credit* (the man who doubts much,

is he who believes more); so it is likewise true, '*Quo magis querimus eo magis dubitamus*' (the further we carry our inquiries, the more room shall we find for doubt and hesitation)."

But let us not forget the prodigious advance which has been made in the industrial arts—the inventions, which have reduced the burdens of human labor and turned it into new channels for the elevation and improvement of the laboring classes. Think, for example, of the improved methods of heating and lighting houses; of the lucifer match, which has taken the place of the old-fashioned tinder-box, flint and steel, which we used in our college days! It was not till 1833 that phosphorus was used in the making of matches. See what a new industry was created. In two establishments on the continent of Europe, more than twenty tons of phosphorus are annually used, giving employment to six thousand persons, and yielding the astonishing number of 44,800 millions of matches as an annual revenue.

What an improvement in locomotion and transportation has been effected! The stage-coach and the canal-boat have been superseded by the more convenient and rapid railway train! Not only has travelling been cheapened, and immensely increased, but rendered more safe. In travelling by diligence in France, the average number of persons injured was one in every 30,000 carried, and in killed, one in every 335,000; but by railway, notwithstanding the average length of the journey has greatly increased, the former has been diminished to one in 580,000, and the latter to one in five millions!

Science is penetrating all our manufactures and occupations. It tends to abbreviate mental and bodily labor. The philosophy of matter is the foundation of all manufacturing arts and artistic processes. By the introduction of the steam engine, the galvanic battery, and machinery in general, the physical toil of the working mechanic has been greatly mitigated by enabling him to *direct* the labor, instead of actually performing it. Science has also proved to be a great source of employment, as well as wealth. The telegraph of the United States alone provides employment for about 7,000 persons; and the railways of the world employ about 1,900,000 men.



But, after all, scientific research can only be successfully pursued by employing the highest motive, viz., a love of truth in preference to all things. It requires less ability to apply knowledge to new purposes, by means of invention, than to *discover* it. The men we reward the highest are not those who *discover* knowledge, but those who apply it. The most eminent discoverer, Faraday, received for his scientific lectures at the Royal Institution only £200 a year, and apartments, during many years; and absolutely nothing for his great discoveries; while the Archbishop of Canterbury receives £15,000 a year, besides the patronage of 183 livings, and a palatial residence and a seat in the House of Peers. Prof. Henry lived on a small salary, about a third only of what is paid to a city judge in New York.

So it has always been. The great thinkers, the great poets, the great artists, the great leaders, who, like Moses, after all their labors and sorrows for others, are permitted to come within *sight* of, but not to *enter*, the promised land! Dante was driven into exile from his beloved Florence; Plautus turned a mill; Terence was a slave; Boëthius died in prison; Tasso died in poverty; Bentivoglio was refused admission into the hospital he himself had erected; Cervantes died of hunger; Camoëns ended his days in an almshouse; Vaugelas left his body to the surgeons to pay his debts, as far as it would go; Galileo was put in prison for expressing an astronomical opinion; John Bunyan wrote his "Pilgrim's Progress" in Bedford Jail; and John Milton sold the copyright to his "Paradise Lost" for £10!

I must no longer trespass upon your good nature, but bring this protracted discourse to a close. Its preparation has been to me a pleasure and a pastime. I hope it may prove not altogether uninteresting to its readers.

MY DEAR CLASSMATES:

We stand here to-day, like trees of some ancient forest, few and scattered! The snows and tempests of many winters have swept over us, leaving us witnesses of the *solitariness* which now surrounds us! Many a stately trunk, with its broad spreading

branches, has been levelled with the dust ! Many a vigorous sapling began to lift its graceful top heavenward, when, alas ! it fell, no longer to lend its beauty to the leafy forest ! We are left standing memorials of the past ! The young sap no longer courses in our veins ! The woody fibre is losing its tenacity ! We are slowly dying ! Soon, not a tree in this beautiful forest of fifty years ago will be left ! The earth will remain. Other forests will throw out their branches to kiss the morning sun ! The dews of heaven, in the coming years, will distil on many a plant and flower ! The gleeful voices of children will be heard at morn and eventide. The song of birds and the bleating of flocks will make glad the hearts which have not yet begun to beat ! We shall be gone ! Transplanted, it is to be hoped, on the banks of the River of Life, in the Paradise of God ! All hail ! Blest Morn of the Resurrection, which shall shine forever upon those who grew here, in the beauty of holiness, the trees of God's own right-hand planting.

Till then, farewell !

# APPENDIX.

This Appendix will consist of :

1. A reprint of the proceedings of the first meeting of the Class in 1842, together with the catalogue of the Class, poem and address.
2. The proceedings of the Class-meeting, in 1862.
3. The proceedings of the last Class-meeting in 1882, with a revised catalogue, giving as full and detailed account of each member as could be obtained. It is a matter of regret that no information could be gained in regard to some ; and it is not known to the compiler of this catalogue whether they are living or dead. It would have been pleasant to have given the salient steps in the life-work of every man ; but this is an unwritten history, and can never be known.
4. Correspondence, etc., etc.

## DECENNIAL ANNIVERSARY.

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NEW YORK, June 1, 1842.

To .....

DEAR SIR :

At a Meeting held in this City, on the 11th of May last, at which several members of the Class which graduated at "UNION COLLEGE" in 1832, were present: the Undersigned were appointed a Committee to make the necessary arrangements for calling a Meeting of the Class at Schenectady, at the next commencement.

Upon comparing notes at the Meeting, we were able to ascertain the residences of most of our Classmates; and we shall address to each of them, an invitation to meet us there; which we trust will be cordially accepted. From the accidental and occasional interviews we have individually had with the Members of the Class, both in and out of the City, they have expressed but one wish on this subject.

The President and several of the Faculty have expressed a desire that such a Meeting might take place, both on account of the pleasure it will afford them to meet the Class, as well as the lasting benefit it may be to the Institution to have so good a custom established. Should such a custom be adopted in succeeding years by the Alumni of the Institution, it will furnish us no occasion of regret, that its origin should be identified with the Class of 1832.

We have therefore, named TUESDAY, the day before commencement, as the time for such Meeting. It will then be ten years



since we parted from each other and went forth into the world—each upon his own errand—and before all those early recollections of school-boy days have entirely faded from our minds, let us be made ten years younger by renewing them. It will be delightful to greet each other once more on the Classic grounds of our Alma Mater, hallowed by so many agreeable associations.

We trust you will not fail to be present. We shall rely upon your presence and coöperation to increase the pleasure of the occasion; and to contribute your share to the common fund of experience and good feeling to be there furnished, which has been accumulating during the last ten years.

Our intentions will be made known to the Faculty without delay.

We are sincerely and truly yours,

G. McM. SPEIR,	} <i>Committee.</i>
J. C. SMITH,	
A. P. CUMINGS,	
N. SHOOK,	
C. E. WEST,	

N. B.—The Residences of the following Members of the Class are unknown to us—if you should know where they reside, will you be kind enough to give them immediate notice of the above.

DANIEL BRANCH,  
NELSON Z. GRAVES,  
WILLIAM P. MAULSBY,  
ABRAM S. MARKS,  
FRANCIS L. UPSON,  
FRANCIS WELSH.

# PROCEEDINGS OF THE DECENNIAL ANNIVERSARY OF THE CLASS WHICH GRADUATED IN 1832.

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At a meeting of Members of the Class which graduated at Union College in 1832, held at the Philosophical Hall, Union College, Schenectady, July 26th, 1842, the following were present:

WILLIAM AUSTIN,	WALTER R. LONG,
ORLO BARTHOLOMEW,	JAMES M. MACDONALD,
GEORGE BOWMAN,	MERRITT G. M'Koon,
JOHN W. BROWN,	EDWARD D. G. PRIME,
ETHAN B. CRANE,	ROBERT O. REYNOLDS,
JONATHAN CRANE, JR.	HAMILTON W. ROBINSON,
ABIJAH P. CUMINGS,	NELSON SHOOK,
EPHRAIM S. HIGH,	JESSE C. SMITH,
CHARLES E. WEST.	

On motion, ABIJAH P. CUMINGS was called to the chair, and ETHAN B. CRANE was elected secretary.

Upon motion, Messrs. M'Koon, MacDonald and Reynolds were appointed a committee to make arrangements for the further proceedings of the meeting.

The meeting then adjourned to meet at the same place in the evening. At which time and place such committee made a report to the meeting, and upon their recommendation the following resolutions were adopted:

*Resolved*, That a catalogue of the Class be prepared containing the names and residences of the members of the Class, together with their respective occupations or professions, and such other information in regard to each member as this meeting may procure and shall deem proper to add to such catalogue.

*Resolved*, That a committee be appointed to prepare a class letter or memorial.

*Resolved*, That some member of the Class be selected to write a poem, as a tribute to the memory of our deceased classmates.

*Resolved*, That a Committee of Publication be appointed, whose duty it shall be to cause the proceedings of this meeting, together

with the descriptive catalogue, circular letter, and poem, to be published and sent to the several members of the Class.

*Resolved*, That a committee be appointed to call a meeting of this Class five years hence, and address the members for that purpose. That such committee select a member of this class to deliver an address at such meeting; and that they also address circular letters of invitation to the members of the classes which graduated the year previous and the year subsequent to this Class, to meet with us at such meeting.

After some time passed in preparing the descriptive catalogue, accompanying these proceedings—

Messrs. Macdonald, West and Smith were appointed the committee to prepare the circular address to the members of the Class.

Rev. John W. Brown was appointed to write the poem to the memory of the deceased members.

Messrs. Robinson, Shook and Austin were appointed the Committee of Publication; and,

Messrs. Smith, Macdonald, Robinson, Bradford, Brown, Reynolds and M'Koon were appointed the committee to call the meeting of the Class five years hence, with power to fill vacancies in their number. (Signed)

A. P. CUMINGS, *Chairman*.

E. B. CRANE, *Secretary*.

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## CATALOGUE OF THE MEMBERS OF THE CLASS WHICH GRADUATED AT UNION COLLEGE IN 1832.

\* prefixed designates such of the members as have been married; † such as are deceased.

\* Thomas Allen, Counsellor-at-Law, Washington, D. C., late editor of the *Madisonian*.

William Austin, Counsellor-at-Law, New York City.

Roger Averill, Counsellor-at-Law, Salisbury, Conn.

\* Rev. Orlo Bartholomew, Pastor of the First Congregational Church, Augusta, Oneida County, N. Y.

- \* Rev. Amos Beach, Rector of Zion's Church, Louisville, Otsego Co., N. Y.
- \* Samuel Belden, Counsellor-at-Law, Amsterdam, N. Y.  
Rev. Abraham L. Bloodgood, Utica, N. Y.  
George Bowman, Counsellor-at-Law, New York City.
- \* Augustus A. Boyce, Counsellor-at-Law, Lockport, N. Y.
- † Lovell Brooks, died at Princeton, Mass., in 1833, 1834.
- \* Alexander W. Bradford, Counsellor-at-Law, New York City.  
Author of "American Antiquities."
- \* John M. Bradford, Counsellor-at-Law, Geneva, N. Y.
- \* Rev. Daniel Branch, Ohio.
- \* Rev. John W. Brown, Rector of St. George's Church, and  
Principal of the Astoria Female Institute, Astoria, Long  
Island, N. Y.
- † Robert T. Cameron, died on his journey to Charleston, S. C., in  
1833.  
Howard Chipp, Counsellor-at-Law, Kingston, N. Y.
- † Rev. Erastus Craft, perished in the steamboat Pulaski, in 1838,  
off Charleston, S. C.
- \* Eliphalet Cramer, Counsellor-at-Law, Milwaukie, W. T.
- \* Rev. Ethan B. Crane, Pastor of the First Congregational Church,  
Saybrook, Conn.
- \* Rev. Jonathan Crane, Pastor of the 2nd Congregational Church,  
Attleboro', Mass.  
Samuel M. Crawford, M. D., Montgomery, Orange Co., N. Y.
- \* Abijah P. Cumings, editor of New York Observer, New York  
City.
- † William Dunn, killed in a duel, in 1833.
- † Peter B. Eager, died at Montgomery, Orange Co., N. Y., soon  
after graduating.  
John T. Flournoy.  
Ferris Foreman, Counsellor-at-Law, Vandalia, Ill., late U. S. Dis-  
trict Attorney for Illinois.  
James Gardener, Counsellor-at-Law, Augusta, Ga.
- † Butler Goodrich, Jr., died at the Theological Seminary, at  
Princeton, N. J., in 1836.
- \* Harry A. Grant, M. D., New York City.

- \* Nelson Z. Graves, Principal of Warrenton Female Seminary,  
Warrenton, N. C.
- \* William H. Hadley, New York City.
- † William Hemphill, died at Malta, Saratoga Co., N. Y., in 1833.  
Rev. E. Scudder High, Elizabethtown, N. J.
- † Nelson A. Hinman, died during senior year in College; his re-  
mains were interred in the College burying-ground.
- \* John Howes, Counsellor-at-Law, Albany, N. Y.  
George N. Jerolomon, left College in junior year.
- \* Rev. Charles Jones, Pastor of Second Presbyterian Church,  
Rome, N. Y.  
Hon. David R. F. Jones, Counsellor-at-Law, New York City.  
John L. Kanouse, Merchant, Bouton Falls, N. J.
- \* Lincoln B. Knowlton, Counsellor-at-Law, Peoria, Ill.
- † Delos Lathrop, died at Albany, N. Y., in 1835, on his return  
from New York, where he had just received his license as  
Attorney-at-Law.
- \* Rev. John N. Lewis, Pastor Presbyterian Church, Truxton,  
Cortland Co., N. Y.
- \* Rev. Walter R. Long, Pastor of the Fourth Presbyterian Church,  
Troy, N. Y.
- \* James J. Lowrie, Union Village, Washington Co., N. Y.
- † William Mann, died at Watertown, N. Y.  
William P. Maulsby.  
John M'Clellan, M.D., Resident Physician at the Lunatic Asy-  
lum, Blackwell's Island, New York City.
- \* Rev. James M. Macdonald, Pastor of the Presbyterian Church,  
Jamaica, Long Island.
- † Edward M'Geoch, died during sophomore year.
- † Andrew D. M'Farland, died at Worcester, Mass., in 1835.
- \* Merritt G. M'Koon, Principal of Oxford Academy, Oxford,  
Chenango Co., N. Y.  
Henry L. Messier, Poughkeepsie, N. Y.
- \* Daniel T. Moseley, Counsellor-at-law, Skencateles, N. Y.
- \* Rev. E. D. G. Prime, Pastor of the Church of Scotchtown,  
Walkill, N. Y.
- † Henry C. Rathbun, Attorney-at-law, died in Florida.



- \* Rev. J. H. Raymond, Professor in Hamilton Literary and Theological Institute, Hamilton, Madison Co., N. Y.
- † Robert O. Reynolds, Counsellor-at-law, Norwich, Chenango Co., N. Y.
- \* Hamilton W. Robinson, Counsellor-at-law, New York City.
- \* Cornelius L. Russell, Counsellor-at-law, Ohio City, Ohio.
- Sidney Sawyer, M. D., Chicago, Ill.
- \* Rev. Abishai Scofield, Pastor of the Presbyterian Church, Petersboro, Madison Co., N. Y.
- † Nelson Shook, M. D., New York City.
- \* Jesse C. Smith, Counsellor-at-law, New York City.
- \* Gilbert McM. Spier, Counsellor-at-law, New York City.
- \* Rev. Ephraim Taylor, Jamestown, N. Y.
- † John C. Taylor, drowned in the State of Alabama.
- Rev. James L. Thompson, late Missionary to Greece, New York City.
- Francis L. Upson.
- † James Walker, Engineer, Utica, N. Y.
- Francis Welch.
- \* Charles E. West, Principal of Rutgers Female Institute, New York City.
- \* Rev. Jahleel Woodbridge, Pastor of Presbyterian Church, L. I.
- † Charles B. Woodburn, died at Spencertown, N. Y.
- William V. S. Woodworth, Teacher, Orange Co., N. Y.

DECEASED MEMBERS OF THE CLASS OF 1832.

Lovell Brooks,	Delos Lathrop,
Robert T. Cameron,	William Mann,
Erastus Crafts,	Andred D. M'Farland,
William Dunn,	Edward M'Geoch,
Peter B. Eager,	Henry C. Rathbun,
Butler Goodrich, Jr.,	John C. Taylor,
Nelson A. Hinman,	
William Hemphill,	Charles B. Woodburn.

## THANATOUSION :

## AN ELEGIAC POEM,

COMMEMORATIVE OF THE DECEASED MEMBERS OF THE CLASS GRADUATED  
AT UNION COLLEGE IN JULY, A. D. 1832.

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BY JOHN W. BROWN, A. M.,

Author of "Christmas Bells," "Virginia," "Merchant's Daughter," "Julia  
of Baile," &c., &c.

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Etsi procul a propinquis  
In morte quiescit,  
Amici plurimi, non sine lachrymis  
Sepulchrum revisent.\*

## I.

From various paths through which our steps have sped,  
From the world's crowded scene of toil and strife,  
With various fortune, in the race of life  
We come, these classic halls again to tread,  
To greet the living, and to mourn the dead :—  
Ten years of stern or bright vicissitude,  
Have passsd in action, big with hope or dread,  
And now we stand again, where oft we stood  
In those remember'd days, a youthful brotherhood.

## II.

Beneath our eye the same fair scene reposes,  
The same bright sky is bending overhead ;  
Greenly, as then, yon mountain belt encloses  
The broad and peaceful plains around us spread ;  
O'er dell and height the summer sunbeams shed  
The same rich splendour, and the waveless breast  
Of yon blue river, winding through the bed  
Of these luxuriant valleys, lies at rest  
Beneath the deep'ning splendors of the burning west.

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\* From the monument erected to the memory of Nelson A. Hinman, in the college cemetery.

## III.

To tones, familiar ones, and ne'er forgot ;  
 Warm hearts are here, whose pulses bound again,  
 Warm hearts are here, unchang'd by joy or pain,  
   Ling'ring once more round this our parting spot ;  
   The toil and change of life's eventful lot  
 Have left youth's chords unbroken, and the flight  
   Of time, the fell destroyer, darkens not  
 Our meeting with his shadows, for the light  
 Of other days brings back their old and calm delight.

## IV.

'Tis well that thus undimm'd, unmarr'd should be  
   The golden links by early friendship wove,  
 When, nerved by hope, from rankling passion free,  
   In learning's toil, with virtuous zeal, we strove,  
   While generous emulation kindled love.  
 'Twere well, if ever in the girded race  
   Of life, the bold aspiring mind could move  
 Obedient to such impulse, and the trace  
 Of boyhood's pure ambition shine in manhood's sterner face.

## V.

Familiar forms are gathered, but not all,  
   For many lov'd ones from our midst are gone ;  
 The ear of death is closed to friendship's call,  
   And the cold grave sends back no answering tone.  
   *One* sleeps 'neath yonder monumental stone,  
 Where our own hands did sepulchre his dust  
   When life's fair prospect most enticing shone  
 To every eye, ere hope had learned mistrust  
 Or her rich visioned gleams by disappointment crost.

## VI.

One sleeps afar beneath a southern wave ;  
   One, by false honor's phantom light lured on,  
 Lies in his lone, unblest, and bloody grave,  
   Yet not unwept by those whose love he won—  
 A generous heart by passion's sway undone.  
   One fell ere young ambition's daring wing  
 Had battled with the storm, on which his eye  
   Unblenched, through year of labor lingering.  
 Read promise of a triumph, pure and high ;  
 In manhood's proudest hour called suddenly to die.

## VI.

Many are gone, whose morning hours were blest  
 With promise of a bright and glorious day ;  
 Some gentle souls sank quietly to rest  
 As the departing sunlight melts away  
 'Mid the delicious bloom and balm of May.  
 Some lie on distant shores, and virtuous deeds  
 Have made their memory holy, and the ray  
 Of blest example, to the gloom succeeds  
 Cheering the heart that o'er the loved and lost ones bleeds.

## VIII.

Fair, fair in memory's moonlight, are they all  
 The young, the bright, the noble. It is true  
 The silent grave returneth not our call,  
 Our voice wakes not their slumber. From the view  
 Of living men, from 'neath yon arch of blue,  
 From this fair earth, forever are they gone.  
 Yet be it ours to pay the tribute due  
 To noble hearts, not with unmanly moan,  
 But in that worthy grief which hallows sorrow's tone.

## IX

Bright be their memory ever,—sweet their rest !  
 May we, when called from life's eventful race  
 To join their silent brotherhood, be blest  
 With hope of heaven, through Christ, our Saviour's grace.  
 Here, as we stand around the burial-place  
 Of a departed brother, let us learn  
 Life's solemn lesson, may no cares efface  
 Its salutary precepts as we turn  
 To the great world whose paths all end in death's sad bourne.

The Committee, to whom was assigned the duty of preparing a  
 CLASS-LETTER, present the following :

In May last, a Circular was issued at New York, inviting a  
 meeting of the Class, which graduated in 1832, to take place at  
 this institution, at its approaching commencement. That circular  
 was sent to all whose places of residence could be ascertained. In  
 compliance with the invitation, we, whose names appear in the  
 Minutes herewith published, being assembled, have directed the

undersigned to express our affectionate salutations to absent members of the Class; and, for their information, to prepare a more full account, than could be gathered from the Minutes alone of our proceedings.

The intimacies and friendships that existed, during our residence at College, led us all to anticipate an agreeable interview. After a separation, and an absence from our Alma Mater for 10 years, spent in different remote societies of the country, and in different pursuits, we should have been greatly disappointed not to have found this an occasion of uncommon interest. The hope expressed in the circular, which convenes us, has, in some degree, been fulfilled; we have felt ourselves made younger by the opportunity of renewing personal intercourse, in these familiar and endeared scenes of our early academical pursuits; and we shall separate and return to our various callings in life, with, at least a portion of the ardour and emulation with which we formerly bade adieu to these classic shades. In a word, we have endeavored, not without some success, to revive the feelings we had, when we were scholars together at this seat of learning, and looked out upon the great, busy, but as yet untried world.

In a familiar and unreserved manner, we have communicated such facts, of a personal nature, as each one supposed would be interesting to Classmates. Particular inquiry has also been made respecting every member of the Class; and with two or three exceptions, interesting statements have been elicited. And could the remarks which have been made—and made in the kindest and most fraternal spirit—be here recorded, they would doubtless impart more of the pleasure we have experienced in being present, than would be possible in any other way. Some of you perhaps would have preferred to answer for yourselves; it is our sincere regret, as it is almost the only abatement to our enjoyment, that you are not present to do so. Be assured that nothing but the most hearty good-will has characterized every statement. It is a source of pride and pleasure, that so many of our number have already met with gratifying success, and enjoy prospects of extensive and lasting usefulness and honor, among their fellow-men.

But although great cheerfulness has marked our present inter-



course, we trust it has been duly chastened by those mournful reflections, which it has not been in our power wholly to suppress. Some are absent whom we shall meet no more. They were endeared to us. They all possessed their good qualities. Their virtues, we will treasure; their failings, bury in the dust. How quickly perished all their hopes and aspirations! But the task of offering a suitable tribute to their memory, we will not forget, has been allotted to other hands; and we know how faithfully it will be performed. It is an affecting thought that more than a fifth of our class have already been called from this scene of earthly labor and trial; and perhaps the chief duty, at future meetings, will be, to take from the catalogue of the living, to increase the catalogue of the dead. But this is not the place to indulge in such forebodings, or to encourage gloomy views of life. Even though our hearts, every moment "are beating funeral marches to the grave," be it ours to fill up life with its appropriate work, never unmindful that only

"That life is long which answers life's great end."

It is due from us to notice, in this communication, our very cordial reception on the part of the Faculty of the college. We, of course, did not do them the injustice of supposing that they would regard our meeting with indifference, but the peculiar interest they have been pleased to express, was wholly unexpected. The institution is highly favored in continuing to enjoy the paternal guardianship of the venerable Dr. Nott. Dr. Proudfit, Dr. Potter, Dr. Yates, and Professors Jackson, and Reed, are still occupying their various departments, with equal honour to themselves, and benefit to the institution. Dr. Joslin now fills a chair of instruction in the University of the City of New York. Professor Averill, who, though one of the youngest of the corps of instructors, gave promise of being one of its brightest ornaments, has been called to an untimely grave. Our kind reception has entitled our Alma Mater if possible, to greater veneration and love, and demands that we should cherish to life's latest moment, the lessons of wisdom and piety we received under her fostering care.

While convened here it has been our privilege to attend a numerous meeting of the Alumni, at which several of the older graduates were present. His Excellency, the Governor of the State, presided; and interesting remarks were made relative to the importance of some concerted action to increase the College Library.

A new Library Room has been fitted up with great elegance—among the embellishments of which, as not the least, we were pleased to notice a full length portrait of Dr. Nott—but the Library remains much as it was, when we were undergraduates, and we must all know that it is far from being worthy of an institution which ranks so deservedly high. At the meeting above mentioned, a committee was appointed for the purpose of raising the sum of \$10,000, to be applied to the improvement of the Library and Philosophical Apparatus, and such measures were taken, as it is hoped will secure the success of the enterprise.

Classmates, you will notice in referring to the minutes of our proceedings, that we propose to have a similar meeting, five years hence. We are especially desirous that there should be, at that time, a full attendance. We have felt grateful to Him who has preserved us, during the interval of our separation—a period which must constitute no small portion of our lives; it is our prayer, that the same beneficent Being would still watch over us, and bring us together, not only with continued proofs of his goodness, but with more grateful hearts.

Classmates! do not forget the proposed meeting at the Commencement in 1847.

JAMES M. MACDONALD,	} Committee.
CHARLES E. WEST,	
JESSE C. SMITH,	

*Union College,* }  
*July 26, 1842.* }

# TRICENNIAL ANNIVERSARY.

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NEW YORK CITY, *July 8th*, 1862.

To \_\_\_\_\_

*Dear Sir* : The undersigned, a Committee of the Class of '32, have pleasure in informing you that there will be a meeting of the surviving members of the Class, in connection with the approaching anniversary of Union College, on Wednesday, the 23d inst., at 2 o'clock in the afternoon, in the Laboratory of the South College.

This being the thirtieth anniversary of our graduation, let us come together to renew the friendship of survivors, and bring into fresh remembrance the many who have deceased.

Our venerable President yet survives.

Respectfully yours,

A. P. CUMINGS, }  
H. W. ROBINSON, } *Committee.*  
E. B. CRANE, }

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N. B.—If you know any member of the Class whom you can reach, by letter or otherwise, please urge his attendance at the proposed meeting.

PROCEEDINGS OF THE TRICENNIAL ANNIVERSARY.

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At a meeting of the Class of 1832, held at Union College, July 23, 1862, were present Messrs. A. P. Cumings, C. E. West, H. W. Robinson, Henry L. Messier, D. R. F. Jones, Orlo Bartholomew, J. C. Smith, Thomas Allen.

On motion, Abijah P. Cumings was called to the Chair, and Thomas Allen was elected Secretary.

On motion, the Catalogue of the Class was called, and all were accounted for as nearly as possible. Letters were read from E. B. Crane and E. Taylor.

On motion, a Committee, consisting of Charles E. West, H. W. Robinson, and the Chairman, was appointed to publish a corrected Catalogue of the Class, together with an address, and the minutes of this meeting.

On motion, it was resolved that the Class will meet again in 1867, and that the last named Committee will notify the same.

Meeting adjourned.

A. P. CUMINGS, *Chairman*.

THOS. ALLEN, *Secretary*.

## SEMI-CENTENNIAL ANNIVERSARY.

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BROOKLYN, April 15, 1882.

Mr. ....

SIR:

At a meeting of the Class of 1832, at Union College, July 23d, 1862, there were present Messrs. A. P. Cumings, Chas. E. West, H. W. Robinson, H. L. Messier, D. R. F. Jones, O. Bartholomew, J. C. Smith and Thomas Allen.

On motion, A. P. Cummings was called to the Chair, and Thomas Allen was chosen Secretary.

On motion, the Catalogue of the Class was read, and such information given respecting its members as was in possession of those present. Letters of regret were received from E. B. Crane and E. Taylor.

On motion, a Committee consisting of C. E. West, H. W. Robinson and A. P. Cumings, was appointed to publish a corrected Catalogue of the Class, with an address, and the minutes of this meeting.

On motion, it was resolved that the Class meet in 1867, and that the Committee give notice of the same.

Above is the record of the meeting in 1862. There has been no meeting of the Class since. As the Fiftieth Anniversary is so near at hand, it is desirable that its observance should be duly honored. It is thought that a larger meeting of the Class can be had in New York than in Schenectady. The Committee, therefore, appoint a meeting to be holden at Delmonico's, Fifth Avenue, New York, on the 15th day of June next, at 4 o'clock P. M., and earnestly solicit your attendance. It is also desired that you will forward, at your earliest convenience, any knowledge you possess of your Classmates, living or dead, that your Committee may be able to prepare a revised catalogue for publication before the meeting.

Please address,

CHARLES E. WEST, *Chairman*,  
138 Montague St., Brooklyn, N. Y.



UNION COLLEGE, April 26, 1882.

DEAR SIR : In the President's absence, I would say that Commencement occurs June 28th (Wednesday).

Class might meet in No. 4 South Colonnade.

It will give us all great pleasure to welcome here the veterans of '32.

Very truly,

WENDELL LAMOROUX.

CHAS. E. WEST, ESQ.

138 MONTAGUE STREET,  
BROOKLYN, N. Y., May 5, 1882.

Mr. ....

SIR :

Circulars have been sent to the survivors of the Class of 1832, calling a meeting at Delmonico's, New York, to celebrate its fiftieth anniversary.

Replies of regret having been received that the meeting could not be held in Schenectady during Commencement week, it is thought best to recall the former invitation and appoint the meeting at No. 4 South Colonnade, Union College, June 27th, at 4 o'clock P. M., the day before Commencement.

CHAS. E. WEST, *Chairman*.

UNION COLLEGE, May 17, 1882.

CHARLES E. WEST, ESQ.,

138 Montague St., Brooklyn, N. Y. :

Glad of change of Class Re-union from New York to Union. Nothing like "home." Keys of rooms are at treasurer's office.

WENDELL LAMOROUX.

PROCEEDINGS OF THE SEMI-CENTENNIAL  
ANNIVERSARY.

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Pursuant to a call made by circular, dated Brooklyn, N. Y., May 5th, 1882, signed by Professor Charles E. West, chairman, the following members of the Class of 1832 met at No. 4 South Colonnade, Union College, Schenectady, on the 27th day of June, 1882, at 4 o'clock, in the afternoon: Prof. C. E. West, of Brooklyn, N. Y., Lieut. Governor Roger Averill, of Danbury, Conn., Gen. Jesse C. Smith, of Brooklyn, Rev. Charles Jones, of Syracuse, N. Y., Hon. Cornelius L. Russell, of Cleveland, Ohio, Rev. Walter Long, of Wheeling, W. Va., and John L. Kanouse, Esq., of Boonton Falls, N. J.

Gov. Averill was called to the chair and J. C. Smith was appointed Secretary. Prayer was offered by Mr. Jones.

Professor West read letters from William Austin, Esq.; H. A. Grant, Jr., for his father, H. A. Grant, M.D.; Rev. Jahllell Woodbridge, A. A. Boyce, Esq., and Rev. Edward D. G. Prime.

The list of graduates of the Class was then read from the college catalogue, and inquiries made from those present in reference to their knowledge or information as to other members of the Class, living or dead, and the residences of the living.

Professor West read sketches of the lives of the following deceased members of the Class, to wit: Butler Goodrich, Alexander W. Bradford, John H. Raymond, Delos Lathrop, Lincoln B. Knowlton, Hamilton W. Robinson, John McClelland, David R. Floyd Jones, Abijah P. Cumings, James M. McDonald, and T. J. Farnham.

The ages of the seven members present were taken and found to range between 70 and 73 years.

The paper prepared by Professor West to be read before the Class included the history of the life of the Hon. Thomas Allen, deceased, but as that part of it had been read at the meeting of the College Alumni in the morning, its reading was omitted here, as was also the reading of that part of the paper written upon other

subjects. But, on motion, Professor West was requested to publish the paper entire, at the joint expense of the members present, with the assistance of Jesse C. Smith and the Rev. E. D. G. Prime, and the meeting adjourned to meet at Given's Hotel, in the evening of the same day. At the informal meeting in the evening the personal history of the members present was given, but it was found that one evening was altogether too short a time to sketch even the smallest part of the lives of seven persons for a period of fifty years, and so another adjournment was had to the next morning before the Commencement exercises of the college. On that morning every moment of time was used to the best advantage, and though but a faint outline of the personal experiences of each member could be given, enough of enjoyment was had to fully repay all who were present for the time and labor spent in coming together.

J. C. SMITH, *Secretary*.

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## REVISED CATALOGUE, 1882.

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\*Deceased.

\* Allen, Hon. Thomas, LL.D. ; St. Louis, Mo. Lawyer, editor, railroad builder, State Senator and Congressman. Died, April 8, 1882.

Austin, William ; New York. Lawyer.

Averill, Hon. Roger ; Danbury, Ct. Lawyer, State Senator, Lieut. Governor, etc.

\* Bartholomew, Rev. Orlo ; Augusta. Died, March 7, 1864.

Beach, Rev. Amos B., D.D. ; Ithaca. Rector of St. John's Church.

\* Belden, Hon. Samuel ; Amsterdam. Lawyer, judge, surrogate.

\* Bloodgood, Rev. Abraham L. ; Monroe, Mich. Presbyterian minister. Died, May 26, 1879.

Bowman, George ; Redbank, N. J. Lawyer.

Boyce, Augustus A. ; Santa Barbara, Cal. Lawyer, clerk of United States Court, Utica.

\* Brooks, Lovell ; Princeton, Mass. Died, 1834.

- \* Bradford, Hon. Alexander, LL.D.; New York. Corporation Attorney, author, lawyer, surrogate, member of the Legislature, Fellow of the Royal Society of Denmark. Died, Nov. 5, 1867.
- \* Bradford, John M.; Geneva. Lawyer. Died, 1861.  
Branch, Rev. Daniel; Chester, Ohio.
- \* Brown, Rev. John W.; New York. Rector of St. George's Church, Astoria; Principal Astoria Female Institute, Poet, author of *Julia of Baia*, etc.
- \* Cameron, Robert T.; Green. Lawyer. Died at Charleston, S. C., 1833.  
Chipp, Howard; Kingston. Lawyer.
- \* Crafts, Rev. Erastus; Hartwick. Perished in the steamboat *Pulaski* in 1838, off Charleston.
- \* Cramer, Hon. Eliphalet; Milwaukee, Wis. Lawyer, banker, philanthropist. Died, Sept. 19, 1872.  
Crane, Rev. Ethan B.; Brooklyn.
- \* Crane, Rev. Jonathan, Jr.; Kalamazoo, Mich.  
Crawford, Samuel M., M. D.; Montgomery.
- \* Cumings, Rev. Abijah P.; New York. Editor of *New York Observer* from 1836 to the time of his death, May 13, 1871.
- \* Dunn, William; Clinton, La. Killed in a duel, 1833.
- \* Eager, Peter B., M.D.; Montgomery. Died, 1833.
- \* Farnham, T. J.; Oregon.
- \* Flournoy, John T.; Hancock, Ga.  
Foreman, Ferris; Vandalia, Ill.  
Gardner, James; New York. Editor of the *Constitutionalist*, lawyer, banker, etc.
- \* Goodrich, Butler, Jr.; Princeton, N. J.. Died at Princeton Theological Seminary, Feb. 12, 1836.  
Grant, Harry A., M.D.; Enfield, Ct. Practiced medicine in Albany, New York and Enfield.  
Graves, Rev. Nelson D.; Middlebury, Vt.  
Hadley, Rev. William H.; Portland, Me.
- \* Hemphill, William; Malta. Died, 1833.
- \* High, Rev. E. Scudder; Streets, Ill. Congregational clergyman. Died, June, 1871.

- \* Hinman, Nelson A. ; Pike. Died in college, senior year, 1832.
- \* Howes, John ; Albany. Lawyer. Died, 1846.  
Joralemon, George M. ; Somerville, N. J. Left college junior year.
- Jones, Rev. Charles ; Syracuse. Pastor of Presbyterian Church.
- \* Jones, Hon. David R. F. ; S. Oyster Bay. Lawyer, member of the Assembly, Senator, Secretary of State, Lieutenant Governor. Died, Jan. 9, 1871.  
Kanouise, John L. ; Boonton Falls, N. J. Merchant, commissioner of Public Schools.
- \* Knowlton, Lincoln B. ; Peoria, Ill. Lawyer and judge. Died, 1854.
- \* Lathrop, Delos ; Albany. Lawyer. Died, 1835.
- \* Lewis, Rev. John N. ; Lodi. Died, Oct. 5, 1861.  
Long, Rev. Walter R. ; Wheeling, W. Va. Presbyterian Bible Agent.
- Lowrie, James J. ; Greenwich. Lawyer and judge.
- Mann, William ; Watertown. Died, 1839.
- Maulsby, Hon. William P. ; Frederick City, Md. Chief Justice of Maryland.
- Marks, Abraham ; Lafayette, La. Lawyer.
- \* M'Clelland, John, M.D. ; New York. An eminent physician. Died, April 12, 1876.
- \* Macdonald, Rev. James M., D.D. ; Princeton, N. J. Pastor of Presbyterian Church in Princeton, author. Died, April 19, 1876.
- \* M'Geoch, Edward. Died during sophomore year, 1830.
- \* M'Farland, Andrew D. ; Worcester, Mass. A student-at-law. Died, 1835.
- \* M'Koon, Merritt G. ; Oxford. Principal of Oxford Academy. Died 1854.
- \* Messier, Hugh L. ; Fishkill. Agriculturist.
- \* Moseley, Daniel T. ; Skeneateles. Lawyer.  
Prime, Rev. Edward D. G., D.D. ; New York. Pastor, editor of the New York Observer, author, etc.
- \* Rathbun, Henry B. ; Florida. Lawyer.



- \* Raymond, Rev. John H., LL.D. ; Poughkeepsie. President of Vassar College. Died, August 14, 1875.
- \* Reynolds, Robert O. ; Cortlandville. Lawyer.
- \* Robinson, Hon. Hamilton W. ; New York. Judge of the Court of Common Pleas, New York. Died, April 7, 1879.
- Russell, Hon. Cornelius L. ; Cleveland, Ohio. Lawyer, capitalist.
- Sawyer, Sidney, M.D. ; Chicago, Ill.
- Scofield, Rev. Abishai, Georgetown.
- \* Shook, Nelson, M.D. ; New York. Died, 1854.
- Smith, Gen. Jesse C. ; Brooklyn. Lawyer, Surrogate of Kings Co., State Senator, 1862-3.
- Spier, Hon. Gilbert McM., LL.D. ; New York. Lawyer, Judge of Superior Court.
- Taylor, Rev. Ephraim ; Akron, Ohio. Teacher and author.
- \* Taylor, John C. ; Schenectady. Drowned in Alabama.
- Thompson, Rev. James L. ; Astoria.
- Upson, Francis L. ; Lexington, Ga. Lawyer.
- Walker, James ; Utica. Civil Engineer.
- Welch, Rev. Francis ; Perry, Me.
- Wells, Rev. Noah H. ; Peekskill. Author.
- Wyman, Thaddeus L. ; W. Springfield, Mass.
- Wiggin, Benjamin ; Boston, Mass. Lawyer.
- Wikoff, Henry ; Philadelphia, Pa.
- Woodbridge, Rev. Jahleel ; Wessen, Miss. Pastor of Presbyterian Church and teacher in Wessen.
- \* Woodburn, Charles B. ; Spencertown. Teacher. Died, 1833.
- Woodworth, William V. S. ; Northampton. Teacher.
- West, Charles E., M.D., LL.D. ; Brooklyn. Principal of Rutgers Female Institute, New York, 1839 to 1851 ; of Buffalo Female Academy, 1851 to 1860 ; of Brooklyn Heights Seminary, 1860 to present time. Admitted as attorney to the Supreme Court of New York, 1844 ; received the honorary degrees of M.A. from Columbia College in 1844 ; M.D. from the University of New York, 1845, and LL.D. from Rutgers College, New Jersey, 1851. Fellow of the Royal Antiquarian Society of Denmark, 1849.

THE LIVING MEMBERS OF THE CLASS IN 1882 AS  
FAR AS CAN BE ASCERTAINED.

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AUSTIN, WILLIAM,	LONG, WALTER R.,
AVERILL, ROGER,	LOWRIE, JAMES L.
BEACH, AMOS,	MAULSBY, WILLIAM P.,
BOWMAN, GEORGE,	PRIME, EDWARD D. G.,
BOYCE, AUGUSTUS A.,	RUSSELL, CORNELIUS L.,
BRANCH, DANIEL,	SAWYER, SIDNEY,
CHIPP, HOWARD,	SCOFIELD, ABISHAI,
CRANE, ETHAN B.,	SMITH, JESSE C.,
CRAWFORD, SAMUEL B.,	SPIER, GILBERT McM.,
FORMAN, FERRIS,	TAYLOR, EPHRAIM,
GRANT, HARRY A.,	UPSON, FRANCIS L.,
GRAVES, NELSON Z.,	WELSH, FRANCIS,
HADLEY, WILLIAM H.,	WEST, CHARLES E.,
JONES, CHARLES,	WIGGIN, BENJAMIN,
KANOUSE, JOHN L.,	WIKOFF, HENRY,
	WOODBIDGE, JAHLEEL.

Total, 31.

# ORDER OF COMMENCEMENT IN UNION COLLEGE, JULY 25, 1832.

## *Music and Distribution of Orders.*

### *PRAYER.*

<i>Sal. ad Gub.</i>	-	-	-	By C. E. WEST,	Phil. Orat.
<i>Sal. ad Curat.</i>	-	-	-	" S. SAWYER,	Class Orat.
Study of the Law,	-	-	-	" J. L. KANOUSE,	"
Study of Hebrew,	-	-	-	" C. JONES,	"
Study of Medicine,	-	-	-	" A. W. BRADFORD,	"
The Theatre,	-	-	-	" W. AUSTIN,	"
Natural Theology,	-	-	-	" J. WOODBRIDGE,	"
National Law,	-	-	-	" J. J. LOWRIE,	"
Greek Literature,	-	-	-	" J. L. THOMPSON,	"
The Civil Law,	-	-	-	" W. MANN,	"
Sacred Music,	-	-	-	" E. B. CRANE,	"
The Study of Logic,	-	-	-	" D. BRANCH,	"
Influence of Russia,	-	-	-	" L. B. KNOWLTON,	"
<i>Latin Oration,</i>	-	-	-	" E. D. G. PRIME,	"
African Colonization,	-	-	-	" P. B. EAGER,	"
The Triumph of Greece,	-	-	-	" J. M. BRADFORD,	"
<i>French Oration,</i>	-	-	-	" J. C. TAYLOR,	"
New York,	-	-	-	" W. DUNN,	"

### *MUSIC.*

Political Constitutions of Europe,	-	By D. T. MOSELEY,	Class Orat.
The State of the Press,	-	" H. W. ROBINSON,	"
Italy,	-	" N. SHOOK,	"
Mental Philosophy,	-	" J. B. CRANE,	"
National Degeneracy,	-	" E. CRAMER,	"
Doom of Genius--a Poem,	-	" J. W. BROWN,	"

### *MUSIC.*

Russia,	-	-	-	By W. R. LONG,	Phil. Orat.
The American Novelist,	-	-	-	" D. R. F. JONES,	Inst. "
Military Glory,	-	-	-	" R. AVERILL,	Phil. "
The Times,	-	-	-	" W. H. HADLEY,	Inst. "
Decline of the Ottoman Empire,	-	-	-	" J. GARDNER,	Inst. "
The Fall of Warsaw,	-	-	-	" G. McM. SPIER,	Adel. "
The Progress of Mind,	-	-	-	" O. BARTHOLOMEW,	Adel. "
Congress of Nations,	-	-	-	" A. P. CUMINGS,	Adel. "

## *Degrees Conferred.*

### *PRAYER.*

## CORRESPONDENCE.

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DANBURY, CONN., April 18, 1882.

DR. C. E. WEST :

*My Dear Sir :* Your letter of the 11th inst. has been received.

I had not forgotten that the fiftieth anniversary of our graduation at college is near at hand. I have many reminders that my college days were a long, long time ago.

A few weeks since I met in Washington some gentlemen from Schenectady who referred to the approaching anniversary of the graduation of the Class of 1832, and expressed an earnest wish that it might be appropriately commemorated. In this I expressed my hearty concurrence. I am in no way committed as to the place of meeting. I have not the means at hand to form an opinion as to the number, or the present residence of our surviving classmates. If the attendance of a greater, or indeed an equal number could be secured at a meeting to be held at Schenectady, I would individually prefer the college to any other place. I will, however, endeavor to conform to any arrangement that you and those about you whom you may consult may decide to make, and will co-operate.

I know nothing of late of Dr. H. A. Grant. A few years ago he resided in Enfield, in Hartford County, Conn.

Hoping soon to hear again from you on this subject, I remain,

Truly yours,

ROGER AVERILL.

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SYRACUSE, NEW YORK, May 2, 1882.

PROF. CHAS. E. WEST :

*My Dear Sir :* I have had some correspondence with Mr. G. M. Spier, of New York, as to a class-meeting at Schenectady next Commencement. We left Union in 1832, a half century since, and I have had an earnest desire for a reunion on the old college grounds. This, to me, would be very pleasant. Where we used

to see the memorable and most excellent President Nott—again to gather and call to mind the past, for me would have a charm. Time, place, and associations would have much to do with my really enjoying a gathering. I have just received a few lines from Mr. Spier, and on another page your printed words. At this stage I think it would be quite impracticable for me to meet at Delmonico's, Fifth avenue, New York city. This would accommodate our Class who are in or near by New York. I think, however, it would be fatal to any general gathering of our classmates who may yet live and be scattered far and near. Please, however, inform me, so far as you are able, *how many* and *who may be expected?*

In 1872 I was at our Alma Mater and shall hope to be in 1882. I can make no special report for any but myself.

With respect, yours sincerely,

CHARLES JONES.

(φBK)

Address: Rev. CHARLES JONES,

146 West Onondaga St., Syracuse, N. Y.

MONROE, MICH., May 15, 1882.

MR. CHARLES E. WEST:

*Dear Sir:* Your circular relating to the anticipated meeting of the Union College Class of 1832 is received, and was mislaid, which is my apology for not writing sooner. My father, Rev. A. L. Bloodgood, went home May 26th, 1879. A statement of some facts relating to his life was sent by request to Rev. Henry A. Hazen, Auburndale, Mass., compiler of vital statistics for the "Congregational Year Book," for publication in the same.

Not having a copy of the statement, I would respectfully refer you to the above-named gentleman, should you wish for the facts therein contained.

Yours truly,

LYNOTT BLOODGOOD.

P. S.—Should you feel so inclined, I would be pleased to receive a copy of the class catalogue when published.

Respectfully, &c.

L. B.



ENFIELD, CONN., May 22, 1882.

CHARLES E. WEST, ESQ.,

*Chairman of Com. of Class of '32:*

*Dear Sir:* Your circular to your classmate, my father, reached him when he was confined to his bed by a long and dangerous illness. Not thinking it would continue so long, he has deferred answering till this time, hoping he might be present. He is now very weak and no better, and has asked me to write you and say how much he anticipated from being present at the reunion in June, but that now he sees it will be impossible. Even if he recovers from his present sickness, it will be many days after the appointed one before he will be able to leave his room. As your circular desires information of other classmates, living or dead, he wishes me to tell you that his college chum, the Rev. A. L. Bloodgood, died at Monroe, Michigan, the summer of '79.

Yours truly,

H. A. GRANT, JR.

SANTA BARBARA, May 27, 1882.

PROF. CHAS. E. WEST:

*My Dear Sir:* Your printed circular of 5th inst., inviting me to meet my dear surviving classmates of 1832, at their semi-centennial gathering, the 27th of June next. at Union College, finds me near 3,000 miles distant, and situated so that I find it quite impossible to join the very interesting *twelve* named in your accompanying letter, viz: "Allen, Averill, Grant, Smith, Prime, Austin, "Boyce, E. B. Crane, Bowman, Russell, West, Maulsby."

And since you wrote it, poor Allen has been called to, as we trust, a sphere where we may all hope to meet.

After a residence of over sixty years in my native State of New York I was persuaded in 1875 to remove to this Pacific slope, to spend the evening of my days under the mild and benignant atmosphere for which this coast of California is so celebrated.

Trusting that I may get a full report of your proceedings, and may yet meet some of my old classmates,

I remember, with sincere affection and esteem, yours,

ANSON AUGUSTUS BOYCE.

WESSON, MISS., June 21, 1882.

DR. CHAS. E. WEST :

*My Dear Classmate:* I shall not be able to be present at the festival of June 29th, as I had hoped to be, and will write to you a few words, which may not be unacceptable to you and the associates of fifty years ago. *Haud immemor*, I shall be present in heart to greet the boys. I see them very distinctly, and if the years have left footsteps, or scattered frost, and if they are getting to be old boys, I shall not see it. In my case, youth is immortal. He was a young man even if he did sit near a sepulchre.

I have never had much to say about myself, because there are so much better models and experiences to present to the world, which I have, in my poor way, been trying to make better. But on this occasion it will be proper to say something as to the course of a life which started from old Union in the July of 1832. Would that I could find a glass which would enable me to trace the path of each of the fifty who on that day went forth from the halls to meet the realities of the life which then were all sunshine.

Till '35 I spent at Princeton Theological Seminary. One year I lived, riding much on horseback, in Maryland; then went to Mississippi, where I spent two years; then to Louisiana, where I remained fifteen years; then to Kentucky fourteen more, and in 1871, necessitated to seek a northern climate by the illness of a member of my family, returned to this State, and the place where I now reside. That does not fill the entire fifty years; but sometimes, in a Bohemian way, I gypseyed. Thus I spent 1870 in Missouri, and perhaps should have been there till now, but for the calamity in my family, which drove me Southward. At times I have taught, usually in connection with preaching, which I always considered my life-work. For several years I was chaplain to the Louisiana penitentiary, and have acted in that capacity to the Legislature occasionally.

My pastorates have been, Baton Rouge, La., fourteen years; Henderson, Ky., twelve; Wesson, Miss., ten.

I have seven children. Two are ministers of the Presbyterian Church, of whom one, just through his theological course, is under appointment as missionary to China. All are members of the

church, two being ruling elders. My daughters, one sixteen, another fourteen, are now at home for school vacation.

I have written no books, but have produced innumerable articles for the newspapers. I have been an omniverous reader, nor do I see any signs of decadence in that respect. I believe that I live in the present as much as I did at thirty, trying to keep along with the age—which, I believe, we sometimes hinted in our college days, is “remarkable.” I have taken a pretty fair look at the “advanced thought,” and “new departures,” “new basis of morals,” *et cetera*, but the God of the Bible, and the Christ Jesus of the Gospel, are as much realities to me as the physical universe.

I am sorry for the honor of Union that I cannot report myself a great man. I have been blessed with warm friends, and in some instances have been strong enough to make enemies. Now and then I find evidences of advanced years, such as a disposition to preach an hour and a quarter, and I doubt whether I should climb the stairs of N. C. S. S. to No. 14 as I used to do, three steps at once, were I to visit the classic shades.

Memory is very busy as I write these lines, but it is only what the occasion will bring out more vividly at the reunion. Grand old Dr. Nott! Prosser with his “rather!”

Beloved classmates! Gratefully and hopefully I greet you, and adieu. Even sunsets are glorious, and there are worlds beyond.

In kindest remembrance, your classmate,

JAHLEEL WOODBRIDGE.

[*From the Chancellor of the Regents of the University.*]

*My Dear Dr. West:* Was not Hon. Thomas Allen a classmate of yours, and will not you respond to the announcement of his death at the Alumni meeting at the coming commencement at Union College? Can you suggest anything for the report? Please let me hear from you.

Yours very truly,

H. R. PIERSON.

UNION COLLEGE, July 18, 1854.

*My Dear Sir:* Your letter, enclosing the resolutions of the Alumni of Union College at Buffalo, has this day reached me through the post-office. Though long in coming, this unexpected testimony of respect from so many beloved pupils is not the less acceptable on that account. Please accept for yourself, and present to the other Alumni in your vicinity, my grateful acknowledgments for the filial sentiments which said resolutions express. That a good Providence may crown their lives on earth with blessings, and that we may all meet eventually in heaven, is the prayer of yours, affectionately,

ELIPHT. NOTT.

CHARLES E. WEST, ESQ.

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[*Letter from Padre Secchi.*]

ROME, July 27, 1877.

*My Dear Mr. West:* I have received to-day your very kind letter, and I am very thankful to you for the good memory you have of me. I have tried your prism with the stars and the sun, and it works very well, but it weakened the light too much on account of the great diffusion; no doubt it would be the best where there is great light, but for small stars the lines are difficult to be seen for defect of light. I have also myself seen one of the spectroscopes of MacLean, but I found it rather poor for great stars—the diffusion is too small; for the small ones it follows that the separation is so small that the lines cannot be seen. I think it is a *joujou* for amateurs. One cannot have measures at all, not even *relative measures* of the distances since the telespectroscope is converted by it into a galilean combination. Besides, M. Browning is not right when he says that several stellar spectroscopes have been invented, but that all of them have been found *unsatisfactory*. Those which I have invented since 1866 are the best used by me during

these last twelve years and with the greatest satisfaction, and nobody has found anything better.

The Count Castracane is not now in Rome, but in England ; he will not come back until next winter. Then I will inform him of what you have written to me.

I hope you are in very good health, and that you have been very much pleased with your travels in Europe.

I am respectfully, truly yours,

P. H. SECCHI.

DIR.<sup>re</sup> DELL' OSS.<sup>o</sup> COLL.<sup>o</sup> ROM <sup>o</sup>



















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